A Case Study of a Microlearning Follow-Up Initiative to Support Training Transfer

Naomi E. Burton-MacLeod

A Thesis
in
The Department
of
Education

Presented in Partial Fulfillment of the Requirements
for the Degree of Master of Arts (Educational Technology) at
Concordia University
Montreal, Quebec, Canada

August 2019

CONCORDIA UNIVERSITY
School of Graduate Studies

This is to certify that the thesis prepared

By: Naomi Burton-MacLeod

Entitled: A Case Study of a Microlearning Follow-Up Initiative to Support Training Transfer

and submitted in partial fulfillment of the requirements for the degree of

Master of Arts (Educational Technology)

complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

Signed by the final examining committee:

Dr. Ann-Louise Davidson_____ Chair

Dr. Richard Schmid_____ Examiner

Dr. Steven Shaw_____ Examiner

Dr. Saul Carliner_____ Thesis Supervisor(s)

_____

Approved by _____
Chair of Department or Graduate Program Director

_____
Dean,

Date _____

Abstract

A Case Study of a Microlearning Follow-Up Initiative to Support Training Transfer

Naomi Burton-MacLeod

Microlearning, a method of providing short, focused, stand-alone information, is trending in professional discussions of workplace training. It is suggested to support training transfer, but empirical evidence of its application and effectiveness is lacking. A mixed-method single case study was designed to answer the question: How do professionals in the early training transfer period following a workshop on a non-routine complex skillset, engage with a microlearning follow-up initiative, where microlearning is provided either as a timed push or by a voluntarily accessed repository? Microlearning was provided after a workshop, either once per week (timed push), or all at once (repository access). Over eight weeks, eight nurses at a tertiary-care hospital participated in various aspects of the data collection through surveys, usage reports and interviews on microlearning use, individual, environmental and design factors. Nurses demonstrated strong engagement with the microlearning regardless of demographics or transfer opportunities. They used microlearning predominantly at work, in a moderately-weak transfer climate. Nurses receiving timed access reported greater ease finding time to use the microlearning than nurses with repository access who tended to use the microlearning all at once. They identified the microlearning duration and its interactive and targeted design as helpful features that prompted recall, active processing and non-formal learning. Nurses' intent to transfer learning was strong both at the time of the workshop and at the end of the study but fluctuated in between, demonstrating a dynamic transfer process. This microlearning initiative demonstrates potential for support of complex, intermittent skillsets in healthcare professional development.

Keywords: microlearning, training transfer, professional development, healthcare

Acknowledgements

I am grateful for the guidance and encouragement of my supervisor, Dr. Saul Carliner, that helped me to trust my instincts and who coached and supported me from the start, even when I was an unknown quantity and seemed to be reaching for the unlikely.

I am grateful to my committee members Dr. Richard Schmid and Dr. Steven Shaw for their input that helped me get my study on the right track and refine it, and to the hospital Continuing Professional Staff Development team for enthusiastically supporting my study idea and helping me through the practicalities of conducting the research. Thanks to my fellow thesis colleague Aysegul Bahcivan for the supportive debriefings and the audit of results.

I would like to acknowledge the financial support of Social Sciences and Humanities Research Council (SSHRC) through the Tri-Council Canadian Graduate Scholarship – Masters and their confidence that I could conduct a study of interest.

Dedication

To my husband, Fabian Jean for taking this calculated risk with me. Your ability to see the long-term goal, your belief that I could pursue the right fit in my career path and your constant, steady love has enabled me to accomplish this. I am forever grateful for your patience, your culinary sustenance and your partnership in life.

To my siblings Sarah, Rebecca and Jonathan, some of the smartest, kindest and most dependable people I know; who encouraged me whole-heartedly on this new path, reminding me of my potential even when I didn't believe it and providing me with key tools to accomplish it.

Table of Contents

List of Tables

List of Figures

A Case Study of a Microlearning Follow-Up Initiative to Support Training Transfer

Chapter One: Introduction

Continuing Professional Development training for healthcare professionals is important for the development and maintenance of skills and knowledge for safe and effective patient care. With constant advances in healthcare, clinicians are required to stay up-to-date in order to provide evidence-based practice. Clinical knowledge and skills are also at risk of decay especially if the situation where they need to be applied does not arise frequently. A well-known example of a continuing professional development strategy to avoid skill decay is cardio-pulmonary resuscitation (CPR) training. Few healthcare professionals have to apply CPR skills regularly but when the need arises, it must be performed optimally to avoid catastrophic consequences. This reality has prompted well-established plans for continuing CPR certification and regular practice, although the optimal frequency remains inconclusive (Yang, 2012). Unfortunately, this example remains an exception rather than the rule in healthcare continuing professional development designs with training limited by time, workforce and budgetary constraints. When investments in training are made in such a constrained but critical context, it is important to consider efficient ways to optimize application and maintenance of the learned skillset.

Accreditation for continuing professional development activities is usually based on the time spent in training and the results of immediate post-training learning evaluations. The subsequent translation of learning into action and the ways that transfer is supported or hampered is often left unmeasured. Appropriate transfer of skills in the workplace however cannot be assumed, especially in the context of patient care. Survey data from experienced training and development professionals in industry approximate that only 50% of training efforts result in positive action by individual trainees (Saks, 2002). In their review of the training transfer literature, Burke and Hutchins (2007) recommend that effectiveness of training is best evaluated by actions resulting from training and furthermore that training programs should provide follow-up support to sustain such transfer. Evidence-based tactics that can support transfer should be implemented in the workplace environment to ensure training effectiveness, which in healthcare equates with better patient outcomes.

Microlearning is a currently trending training method which is used to deliver information in time limited, objective-specific packages that could prove useful in the design of

post-training support to counter learning decay and enhance training transfer. There is little empirical evidence describing theoretically-driven application of microlearning in the workplace for performance improvement. The purpose of this study is to explore and describe the implementation of a microlearning follow-up to training initiative and to better understand if it is perceived as useful and supportive of training transfer. Understanding how it is used during the initial transfer period after training and what moderates its use will provide valuable information for future research or implementation of microlearning transfer support of complex skills in a healthcare setting.

Research Questions

Main Question. How do professionals in the early training transfer period following a workshop on a non-routine complex skillset, engage with a microlearning follow-up initiative, where microlearning is provided either as a timed push or by a voluntarily accessed repository?

Supporting Questions.

*SQ A***.** How will individual and environmental factors influence the use and perceived utility of microlearning?

SQ B. How will delivery method (timed push vs. voluntary pull) influence participants engagement with microlearning and why?

*SQ C***.** How will participants use of microlearning interact with their transfer attempts?

SQ D. For users of microlearning, how supportive will they find the format and content for their application of the complex skillset? Will participants perception of microlearning support vary based on how microlearning was provided?

SQ E. How will participants use of microlearning impact their use of other sources of support in the environment? Will microlearning prompt non-formal learning among colleagues?

Chapter Two: Literature Review

Preview

Study question development was guided by a review of training transfer frameworks established from research in the field over the last 30 years. The issue of suboptimal training transfer in the workplace has persisted, prompting ongoing research to understand how to support transfer in evolving work environments. Among the variables known to influence transfer, training design for support of transfer is modifiable by training professionals when informed by knowledge of the workplace environment. Acknowledgement of the role of both formal and non-formal learning in the workplace raises the question of how training design can foster non-formal learning opportunities given its potential to support transfer. Finally, the utility of a microlearning approach, its origins in prior training methods and principles and its potential for training transfer support will be reviewed.

Theoretical Frameworks

Baldwin and Ford in their 1988 review of the literature on training transfer developed a model of training transfer that persists today although further layers and points of connection have been added (Alvarez, Salas, & Garofano, 2004; Blume, Ford, Surface & Olenick, 2019). The model consists of three main categories of variables that influence transfer: 1) individual characteristics, 2) work environment variables and 3) training design (Baldwin and Ford, 1988). Individual characteristics were originally defined by Baldwin and Ford (1988) as a trainee's cognitive ability, motivation and personality but subsequently these were expanded to include characteristics such as an individual's perception of training usefulness and their self-efficacy (Burke & Hutchins, 2007; Grossman & Salas, 2011). Work environment variables were not well defined by Baldwin and Ford (1988) due to a lack of research at that time but included support for transfer, such as rewards, and the opportunity to use acquired skills. Subsequently there has been further exploration of environmental variables which now includes the alignment of training and organizational goals, support for transfer from both managers and colleagues, and work climate which includes both prompts for transfer and impactful consequences for use or non-use (Burke & Hutchins, 2007). Training design elements identified by Baldwin and Ford (1988) to influence transfer were the use of design that was based on learning principles, the match between training content with learner's needs and appropriate spacing of practice to match the skill being learned. In their review of the training literature, Burke and Hutchins (2007)

notably added self-management strategies and use of technological support in training as design variables that are reported to support transfer but require clarification on when they are best indicated. As one of the more readily manipulated variables, training design, can be situated in a broader concept of transfer design according to Arthur, Bennett, Edens, and Bell (2003), where strategies can be implemented before, during or after training that facilitate application of what was learned. It is anticipated that when a transfer design support strategy is implemented, it's effectiveness will be influenced by individual and work environment variables and in turn may have a reciprocal effect on these variables.

The dynamic transfer model recently proposed by Blume, Ford, Surface and Olenick (2019) focuses on the initial transfer period following training, not counting transfer as complete after the first attempt. Instead, the transfer process is viewed as iterative with variables known to influence transfer reassessed by the user after each transfer attempt and reshaping their intentions to transfer. The coupling of intention to realized action may be more fragile in this period depending on individual and environmental variables. This underscores the need for support during this period in order to have a sustained effect. Regarding initial transfer attempts, because training often covers complex skillsets, Blume et al. (2019) posit that the first attempt is not likely to utilize all aspects of the skillset. Furthermore, if the opportunity to implement is delayed, then knowledge decay can start to factor into the transfer model. Blume et al. (2019) delineate that after each transfer attempt, re-evaluation of trained knowledge, capacity and intentions occurs through self-evaluation and external feedback if available in the context. According to Blume et al.'s Dynamic Transfer Model (2019), a transfer attempt can therefore refine and build upon prior experiences with the first transfer attempt strongly impacting subsequent attempts because of how it reshapes knowledge and intentions, either strengthening resolve to transfer or limiting further attempts. Adopting this ongoing perspective of transfer means that support for transfer should also be available over time and is particularly critical during the early transfer period to ensure sustained and optimal application of training.

Intentions, according to Ajzen's Theory of Planned Behavior (1991), come just before and are predictive of action. Al-Eisa, Furayyan and Alhemoud, (2009) define intention to transfer as a higher-level construct closest to the act of transfer that can capture data on other preceding individual variables such as motivation and self-efficacy. This is useful as there is an interconnectedness between these preceding variables that can make evaluation of these

individual components both complex and difficult to interpret. Motivation, for example can be split into motivation to learn and motivation to transfer. Motivation to transfer is subdivided by Gegenfurtner (2013) into further dimensions of autonomous and controlled transfer motivation, with autonomous motivation being more predictive of intention to transfer. The effect of self-efficacy on transfer intentions has been reported to be mediated in part by motivation (Al-Eisa et al., 2009). Intention to transfer can therefore be used as a proxy measure of individual transfer performance according to Hutchins, Nimon, Bates and Holton (2013).

Training Transfer Issue

Trained skillsets are subject to decay especially when there is an interval between training and application, when the skills being trained are complex or are open-looped tasks that require constant monitoring, and when skillsets have a high cognitive compared to psychomotor component (Wang, Day, Kowolik, Schuelke & Hughes, 2013). Knowledge decay results in reduced transfer unless steps are taken to counter this loss of training retention. Interventions that have shown some promise in counteracting decay include: overlearning, testing, spaced reinforcement, goal setting and development of relapse prevention plans (Gaudine & Saks, 2004; Kim, Ritter & Koubek, 2013; Russ-Eft, 2002; Thalheimer, 2006; Wang et al., 2013). Many of these interventions are applied at one timepoint immediately following training or are relevant only if there is control over the opportunity to apply (goal setting) or risk that cues for application will either not be recognized or respected (relapse prevention). In contrast, spaced reinforcement is relevant for situations where opportunity to apply the skill is intermittent or unpredictable since it supports recall and practice over time.

When indications for training application are clear but opportunities to perform are not immediately available, strategies aimed at knowledge retention would be an appropriate intervention to moderate training decay. Spaced distribution has a long history of being well suited to enhance knowledge retention (Donovan & Radosevich, 1999; Son & Simon, 2012) but factors that may moderate its effectiveness, such as the type of task or skill being taught, the associated duration of retention, its application in workplace settings, and specifically the impact on knowledge transfer remain to be more fully elaborated (Donovan & Radosevich, 1999). Training best practice guidelines drawn from a review of the literature by Salas, Tannenbaum, Kraiger and Smith-Jentsch (2012) recommend that "…[organizations] provide refresher training when decay cannot be avoided" (p. 84) and provide "access to knowledge repositories" (p. 92)

after training to facilitate performance. Similarly, Salas and Stagl (2009) outline recommendations according to the science of training including that trainees be encouraged to review and reflect on training after its completion in order to counter decay. How this can be operationalized in a workplace setting and what factors moderate the expected transfer support remain areas for further exploration.

Microlearning

Preview and definition. Microlearning can be defined as temporally short, stand-alone learning experiences that are designed to cover one to two actionable learning objectives (Hug & Friesen, 2007; Shank, 2018). While the general consensus is that the duration of microlearning should be less than 15 minutes (Kapp & Defelice, 2018), ultimately the length of micro-learning is part of the design decision-making process and should match the learning need, content and audience (Eibl, 2007). Microlearning can take many forms, ranging from short videos, to job aids, quizzes with feedback or case studies. Regardless of the medium, the goal of microlearning is to provide focused, essential information on a specific topic required by the user so that they can readily apply the information (Kapp & Defelice, 2018). To meet this goal, microlearning must be guided by relevant learning principles in order to facilitate transfer. Relevant principles and methods that have forged the path for microlearning will now be presented.

Learning principles. The limits of cognitive capacity for processing information were first outlined by Miller (1956) who detailed how information is initially received in the working memory and from there is either funneled into long-term memory or discarded (Artino, 2008). The mental effort it takes to funnel this information can be called cognitive load and according to Sweller's Cognitive Load Theory (1988) can be accounted for by three sources: 1) extraneous load which is unnecessary mental efforts most often imposed by the way information is presented, 2) intrinsic load which is the inherent complexity of the information and 3) germane load which are the mental efforts to enhance the recall of information from long term memory (Artino, 2008; Sweller, van Merriënboer, & Paas, 1998). Due to its brevity, microlearning design must be efficient and stream-lined for the chosen objective which can help to limit extraneous load. With extraneous load decreased, design approaches that increase germane load, such as introducing variations in scenario presentation and practice, can be more readily employed since there is a buffer keeping total cognitive load from exceeding working memory limits (Sweller, van Merriënboer, & Paas, 1998).

The training transfer literature focuses on formal training episodes, but workplace learning can also occur outside of formal contexts whether in conversation with colleagues or through self-directed learning. The distinction between formal and non-formal learning has been made by Eraut (2000) based on whether it is being delivered by a specified person for intended, externally recognized outcomes with prepared material designed according to a chosen framework (p.114). Non-formal learning falls outside of these bounds, occurring on the job and with varying degrees of conscious intention to learn (Eraut, 2000). This distinction leads to the question of whether formal learning can be designed in a way that prompts non-formal learning. A novel aspect, a consciously prompted discussion, or a shareable artefact of training such as a short video or job aid could promote informal discussion between colleagues due to the way it has been designed and its use in the workplace. For this reason, Chisolm (2005) "situates the micro-learning agenda in proximity to that of non-formal and informal learning" (p. 5).

Different formats of microlearning. The focused format of designed microlearning is a key characteristic that enables it to be referenced even in a time-constrained workplace; framing the content as actionable objectives further supports the application of the learning content according to Eibl (2007). These efficient characteristics also allow for an element of choice to be provided to the learner, where they can select both the desired content from a library of topical microlearning information and the timing in which they use it. Giving such agency to learners can help them personalize their learning and support their individual transfer experiences. This autonomous selection by the learner from a library can also help ensure that they interface with the microlearning when they are most motivated to learn or in a context where they are just about to apply the information. This concept of placing relevant, supportive information in a readily accessible platform that can be consulted while 'in action' is an extension of Electronic Performance Support Systems (EPSSs). Microlearning follows in the path of EPSSs which offer 'just in time' learning opportunities based on a performance need and are embedded in the software or system of use for digitally-based work (Gery, 1995; Carliner 2002). Microlearning, although less seamlessly integrated into workflow than an EPSS, can still be placed for convenient reference in the context of a wide variety of job functions to be referenced as needed for completion of a specific action. Yet even if placed in a convenient location (physical location or accessible digital resource) use of a microlearning reference library is still reliant on both the

awareness and the initiative of the user, requiring the user to seek it out in order to have an effect on performance.

One way of countering the potential barrier to microlearning use when fully dependent on the initiative of the user, is to have microlearning pushed to learners in a planned sequence and timed frequency. Such timed follow-ups, also called subscription learning, place the information in front of the learner as a reminder of content and a prompt to review which has been suggested by multiple training practitioners (Emerson & Berge, 2018; Kapp & Defelice, 2018; Shank, 2018; Thalheimer, 2015). This approach builds on the concept of spaced learning and may be incorporated as an element of transfer design with the goal of optimizing knowledge retention which is essential for knowledge transfer. Despite the evidence for the efficacy of spaced learning, it is a learning methodology that can be challenging for the user to employ without a built-in framework of support; they may not be fully consciousness of their own knowledge decay. Additionally, engaging in delayed recall can make the user feel less assured in their knowledge in that moment, making it a hard learning method to sustain even if it will provide long-term gains (Brown, Roediger & McDaniel, 2014).

Thus, both methods of providing microlearning have advantages and challenges especially when being deployed in the context of a busy workplace with multiple competing demands for time. Although microlearning has been identified as a major trend in training in current professional publications (Kapp & Defelice, 2018; Salas, 2017) there is surprisingly little empirical evidence demonstrating its effectiveness in the workplace (Duvernet & Whelan, 2017). Given the theoretical support for delivering microlearning as a 'just in time' reference and also as a timed subscription, a contextualized comparison of the two methods when used as transfer support is worth exploring. This would help elucidate what moderates or facilitates this promising format of training transfer support and delineate what should be considered for future applications and study of its effectiveness.

Providing perspective and a roadmap for future research directions, some 30 years after Baldwin and Ford first proposed their foundational model of training transfer, Ford, Baldwin and Prasad (2018) call for transfer research to be conducted in "authentic contexts…consistent with how learning is occurring in organizations today and into the future." (p. 211). With follow-up recommended in the initial post-training period to promote transfer (Russ-Eft, 2002), this study will look at a promising microlearning follow-up initiative for training transfer support.

Chapter Three: Methodology

Preview

Research is required to explore how microlearning can be applied in an operationalized setting, guided by learning theories and how it is subsequently used with the intent of supporting training transfer. The rationale for the choice of methodology selected to answer the research questions and a detailed explanation of how data were collected and analyzed will be now be delineated. The proposed study is designed to answer the following questions:

Main Question. How do professionals in the early training transfer period following a workshop on a non-routine complex skillset, engage with a microlearning follow-up initiative, where microlearning is provided either as a timed push or by a voluntarily accessed repository?

Supporting Questions.

SQ A. How will individual and environmental factors influence the use and perceived utility of microlearning?

SQ B. How will delivery method (timed push vs. voluntary pull) influence participants engagement with microlearning and why?

SQ C. How will participants use of microlearning interact with their transfer attempts?

SQ D. For users of microlearning, how supportive will they find the format and content for their application of the complex skillset? Will participants perception of microlearning support vary based on how microlearning was provided?

SQ E. How will participants use of microlearning impact their use of other sources of support in the environment? Will microlearning prompt non-formal learning among colleagues?

Selection of Research Methodology

One way of exploring the degree of transfer support provided by the microlearning initiative would have been to collect quantifiable data from a large pool of nurses and then analyze the strength of the relation between microlearning use and transfer behavior over an extended period of time. A large, controlled dataset would have been necessary for determination of significant difference between the two delivery methods in terms of usage and transfer outcomes. Furthermore, a standardized and measurable transfer behavior would be required for such a design but nursing care and results for patient care is based on a team approach. This means that it is often difficult to attribute results to a single intervention or individual especially

in the application of a complex skillset. An adequate sample size to sufficiently power such an analysis was not also possible given the participation caps placed on the workshop due to feasibility and fiscal constraints. These factors precluded the use of a quasi-experimental design to compare quantifiable transfer outcomes related to microlearning use or non-use after the workshop. Finally, conducting a quantitative study in a real-world setting, with limited control over contextual and individual factors was riddled with challenges for establishing adequate control of potentially confounding variables.

Instead of controlling for the moderating variables, it was determined that a descriptive approach would provide valuable information on the potential of microlearning for transfer support and an increased understanding of the variables that could influence it's use and supportiveness within a healthcare setting. For this reason, a qualitative design was chosen to explore and describe the interaction of professionals with microlearning and factors moderating this interaction and skillset transfer. By gathering data on use and engagement with a microlearning initiative by professionals in their typical workplace context, knowledge will be gained about what influences this form of transfer support, including the manner in which it is delivered. A case study fits with the descriptive goal of the study questions and allows for an exploration of training support through a microlearning initiative in an operationalized context. According to Yin (2009), "…case studies are the preferred method when (a) "how" or "why" questions are being posed, (b) the investigator has little control over events, and (c) the focus is on a contemporary phenomenon within a real-life context." (p. 2). Each of these conditions were met by this study as it explores and describes the use and perception of microlearning follow-up while it was occurring during the initial transfer period in the multifactorial environment of the hospital workplace.

How the Study Was Conducted

To be able to answer the study questions, a site was required where training transfer issues were present and where microlearning could logically be integrated in response to this need. Access to an adequate pool of potential participants was also key. The rationale for the selection of the study site and participant criteria will now be detailed.

Site. A workplace setting was required that met the following four conditions:

- A workplace where complex skillsets are used.
- Training is provided to support the development of the required complex skillsets.

- The opportunity to apply the skillset is unpredictable (non-routine) leaving the trained skillset vulnerable to decay.
- Where microlearning reinforcement of training can be implemented as a means to support transfer.

Drawing on the researcher's professional background as a nurse with knowledge of healthcare workplaces, such a representative site was identified at a public, tertiary care hospital centre that has its own continuing professional development (CPD) department. The healthcare centre was conveniently located in the same metropolitan region as the university through which the research was being conducted, and the Researcher had prior work experience at the centre. The CPD department was approached about upcoming training events and a workshop on a non-routine complex skillset with 50 anticipated attendees was scheduled for February 2019. The workshop was on evidence-based wound care. Microlearning had been used by the department for stand-alone delivery of training on protocol change, but it has not yet been employed as a post-training support. Interest was expressed on the proposed implementation of microlearning as follow-up support to this workshop to enhance transfer of this complex skill given the unpredictability of opportunities to apply the skillset on return to the workplace. When the workshop had been given in previous years, feedback from participants identified it as content-heavy, with a lack of time for sufficient coverage of all outlined topics despite being a full day (L. Aziz, personal communication, November 13, 2018). It was also noted by participants that there was limited informational supports for reference after the workshop (L. Aziz, personal communication, November 13, 2018). This case site therefore met the criteria of requiring training-specific transfer supports and also had the capacity to support microlearning delivery.

Participants. In accordance with the research questions, participants needed to be professionals working at the selected site who had recently received training on a complex skillset, intermittently applied in the workplace. Since the workshop was specific to an element of nursing practice, the pool of potential participants were exclusively nursing professionals working at the tertiary hospital centre who were voluntarily attending the accredited workshop on evidence-based wound care.

Inclusion criteria. In order to participate in the study, workshop attendees were also required to meet the following inclusion criteria:

- Have achieved a score on the training post-test of 80% or higher. This is the standard set by the hospital Continuing Professional Staff Development division of the Nursing Department for awarding CPD training credits.
- Have an email account and an internet-connected digital device or computer to receive study information and access links for microlearning.
- Have given fully informed consent to participating in the study, being aware that they could withdraw at any time.

Exclusion criteria. Nurses who failed to achieve a post-test score sufficient for accreditation of the CPD training were to be excluded from the study. This exclusion criterion was specified since the nurse must demonstrate an adequate level of learning from the initial training to be able to transfer the training on the job. The microlearning provided was not intended as remediation but rather to support maintenance of the skillset. Additionally, any nurse not achieving accreditation was to receive follow-up by the workshop facilitators and their unit nurse educator for review of information and to determine remediation to ensure safe practice.

Ethics approval. Prior to recruitment, the study protocol, data collection measures and information and consent forms were submitted for ethics approval (see Appendix H and I). Ethics approval was obtained from both the McGill University Health Centre Research Ethics Board and Concordia University Human Research Ethics Committee. Amendments to the protocol were likewise submitted to both Ethics Boards and approval received prior to initiating the change in protocol.

Recruitment. All nurses attending a non-mandatory but accredited workshop on evidence-based wound care were presented with the opportunity to participate in the study. During the all-day workshop training, information was provided by a script (see Appendix J) introducing the study and read by one of the workshop facilitators. This information included a brief description of the microlearning to be provided and the type of involvement required by participants. Consent forms were then distributed and an opportunity to ask questions provided. Workshop attendees were asked to return the consent forms, whether completed or not, by placing it in a sealed box as they left the workshop at the end of the day. In this way confidentiality regarding the choice to participate was maintained.

Assignment to case subunit. Participants were assigned to one of the two delivery method subunits for microlearning distinguished by the timing of access to the microlearning.

Participants either received sequential-timed access or full repository access. Assignment was determined by the Researcher according to the demographic data provided by the participants in the Initial Questionnaire: Job title (Supervisory Role or Staff Nurse), work unit, years of experience, and education level. Job title and work unit relate to variables in the work environment that can potentially influence the sources of support available after training and the opportunity to apply the training knowledge to the job. A nurse who is in a supervisory role, such as a Nurse Educator, may have more opportunity to practice and to share their wound care skillset with colleagues but may have less peer or supervisor support than staff nurses. The unit of practice may also influence the opportunity to apply wound care skills as well as the ease of access to microlearning in the workplace. A participant's years of nursing experience and education level are individual characteristics that could influence a nurse's self-efficacy, intention to transfer knowledge and the perceived usefulness of training.

The aim during assignment was to ensure an equal distribution of these characteristics between the two microlearning subunits. To achieve this, the first round of assignment was based on work unit and job title with the second round of distribution being to equalize the years of experience and education levels between the subunits. Participants working on the same unit were assigned to receive the microlearning by the same delivery method since interaction and discussion among nurses from the same unit was expected. By grouping them into the same microlearning delivery subunit, the anticipated sharing of information and microlearning during the initial transfer period would not interfere with distinguishing differences between the delivery methods. This approach to assignment between microlearning delivery subunits optimized the representation of demographic characteristics within each subunit, facilitating analysis.

How Data Were Collected

The study took place over the course of eight weeks following a workshop on a complex, non-routine skillset. A concise definition of the case, the components of the case during the defined timeframe and the data collection process will now be provided.

How the case was defined. The study is aimed at understanding how microlearning, when used as training support, is operationalized in the workplace. The unit of analysis for this case study is an initiative providing microlearning transfer support following a workshop and that is offered in two training-science supported delivery methods: a) sequentially timed access,

or b) repository access for just-in-time reference. These different timing of access to the microlearning creates "embedded units" (p. 46) in the case study according to Yin (2009). The timeframe for the case was set as the initial transfer period, defined as the eight weeks following an initial workshop on a complex skillset, more specifically wound care, provided by the hospital Continuing Professional Staff Development department. Nurses working within the same hospital centre, who successfully completed the workshop were invited to participate.

The steps in the microlearning initiative roll-out and the data collection tools used during the case study will now be described.

Initial task (workshop training). Of note, the workshop described here is not part of the study but rather qualified the nurses in attendance for participation in the study. The workshop was a six-hour, accredited training on evidence-based wound care that had been coordinated by the hospital's continuing professional staff development team. Being an accredited training event meant that if nurses achieved a score of 80% or higher on the post-test administered at the end of the workshop, they earned a certificate of six hours continuing professional development. These hours are accumulated and submitted to the nursing professional body annually in order to maintain an active license to practice the profession.

The workshop was also provided during paid work hours and held within hospital facilities but away from clinical units. As it was not a mandatory workshop, nurses were required to submit a request to attend the training to their nursing manager a month in advance. Nurses who had their request approved were able to attend the workshop. In total, there were 52 nurses from different units in attendance, all of whom are employees at the hospital site.

Wound care requires a nurse to assess a patient's wound status and risks, develop an appropriate care plan to communicate how to treat the wound and minimize risks, implement the care required when caring for the patient, and evaluate the outcome of the interventions and wound healing, adjusting the plan or consulting a wound care specialist as required. These steps become a team effort with nurses handing-off care from shift-to-shift as wound care is ongoing. The opportunity to apply knowledge and skills about wound care varies within the hospital system depending on the patient population being served, but still can occur in any care department. Thus, the opportunity to apply wound care skills is non-routine, being dependent on the reason for a patient's hospital care, the presentation or development of a complex wound and furthermore the assignment of patient cases to nurses during any given shift.

Follow-up tasks (microlearning). Three microlearning follow-ups were provided to nurses participating in the study after they had completed the workshop training on wound care. Each microlearning provided information aligned with one of the workshop learning objectives and took no more than 10 minutes to complete. The microlearning modules were identified by a title that concisely indicated the topic and objectives. Microlearning was designed to include the following strategies based on training science and recommended by Salas, Tannenbaum, Kraiger and Smith-Jentsch (2012): recall of workshop content, testing-effect through quiz questions with feedback and decision-making interactions. Each microlearning concluded with a short, standard survey of three questions (see Appendix B). A detailed description of the microlearning content, design and development is presented in Chapter Four: Design and Development of Microlearning Follow-Up Initiative.

How microlearning was provided. The microlearning was provided in two different ways. One subunit of nurses received the microlearning as a timed push, enabling sequential access to the content. This meant that from the time of launch, they received a weekly e-mail with a link to the next microlearning module. The link took them directly to the specific microlearning content housed on SCORM Cloud (Rustici Software). Nurses were asked to complete the microlearning module as soon as possible after receiving the e-mail.

The second subunit of nurses received simultaneous access to all three microlearning resources at the same time. The nurses received the three links to the microlearning module via e-mail at the time of launch. The access to all microlearning remained available for this subunit throughout the remainder of the study.

Data collection. Data were collected in several ways during this study and were obtained at different timepoints of the initial transfer period. The data collection steps and rationale for each type of measurement will be presented in the sequence in which they occurred during the eight weeks of the study.

Baseline questionnaire. At the time of recruitment and informed consent during the initial training workshop, a short questionnaire collecting demographic and descriptive baseline data was distributed (see Appendix A). The questionnaire was designed to collect demographic data including the nurse's unit of practice, role, years of experience, and education. To determine opportunity for immediate application of training even prior to microlearning use, nurses were asked if they were currently caring for a patient requiring wound-care. Asking nurses to rank

commonly available resources available for reference (i.e. informational resources, colleagues and specialists) allowed for an assessment of any differences in ranking of these resources before and after the introduction of microlearning. These resources were identified from the observation and experience of the Researcher who had worked in a cross-section of nursing units within the case study site. Drawing on the theoretical framework of Baldwin and Ford (1988), participants were also asked to indicate the types of environmental transfer support that they anticipated to be available to them after the workshop. This list included supervisor and peer support, adequate time to apply skills and environmental prompts as a way to capture nurse's perspective of their workplace transfer climate. The questionnaire concluded with a measure of the nurse's intent to transfer as designed by Gegenfurtner (2013) to which the respondents indicated their level of agreement using a five-point Likert scale. Intention to transfer was selected as the individual variable closest to the behavior of transfer and also preceded by motivation and self-efficacy inputs (Al-Eisa et al., 2009; Gegenfurtner, 2013; Hutchins et al., 2013). For the individual variable of cognitive ability this was assured in the context of this study by participants having achieved accreditation on the initial workshop post-test and also since the participants are part of a professional order that ensures competency through educational standards and licensing exams prior to entry into the profession. Finally, motivation to learn can be assumed among the nurses who have self-selected to participate in a non-mandatory workshop on wound-care because of interest and relevance to their work and subsequently chosen to participate in the study.

Usage data. Initially the launch was planned to occur on the hospital's Learning Management System (LMS), as it would be familiar to participating nurses and ensure access to microlearning within the hospital system. The launch on the hospital LMS was not supported however as at the time of initial launch (12 days after the workshop) participants were unable to locate the microlearning where it had been uploaded by the administrator. A lack of uniquely dedicated space for the microlearning within the hosting system had prompted the administrator to embed the microlearning in unrelated existing courses in order to enable discreet access to modules. However, it required an unanticipated multi-step access process and the participants landed on an unrelated homepage which gave no signal of the microlearning being embedded within. Given the degree of inaccessibility, multiple users reported errors with the links to both the Researcher and the administrator. An alternative, direct access route within the hospital LMS was not feasible and so following an approved amendment to the protocol, the microlearning was

relaunched two weeks later on SCORM Cloud, an online learning management platform. This amended platform allowed similar usage data collection and one-click ease of access for participants. Accessibility of microlearning on SCORM Cloud from hospital computers was tested and confirmed prior to the second launch. The following usage data for each participant were collected:

- Date, time and duration of each microlearning access
- Responses to embedded quiz questions and time spent on each question
- Responses to survey questions at the end of each microlearning

Microlearning usage and question responses embedded in the microlearning were collected on a weekly basis following the launch. Participant usage data were exclusively available to the Researcher as sole manager of the SCORM Cloud account. This information allowed for analysis of patterns or trends regarding engagement with microlearning both within and between the subunits of the case.

Microlearning session survey questions. At the end of each microlearning, the same brief set of survey questions were presented to the user to capture data at the time of use and over the period of microlearning usage (see Appendix B). Nurses were asked to indicate if they had used other resources (i.e. peer, supervisor or informational) since the training and if so, to describe them. They were also asked if they had spoken about or shared the microlearning with peers, opportunities to apply the training on the job and if so, if it occurred on the same day as the microlearning use. Finally, they were asked about their intent to transfer the training at the time of completing the microlearning, with training referring to both the workshop and complementary microlearning received to date. This allowed for comparison of participants' intent to transfer their wound care skills over time during the initial transfer period.

Final questionnaire. A final electronic survey was distributed to participants during the sixth week following the workshop (see Appendix C). Participants were asked for descriptive information on their experience during the initial transfer period when microlearning was available. This questionnaire link (hosted on LimeSurvey) was sent by e-mail to all study participants regardless of whether they used the microlearning or not with the intent of capturing data on why microlearning engagement was or was not used. The questions in the survey were branched based on participants' response to the question: "Were you able to use the microlearning resources since the workshop? Yes/No." The final questionnaire collected

information on the number of opportunities study participants had to use their wound care knowledge and if used, what motivated them to apply this knowledge. They were also asked about discussions they had with colleagues about wound care in order to identify instances of non-formal learning. Finally, three questions were repeated from the initial questionnaire in order to compare participants responses from the start of the initial transfer period to the end: 1) supports available during the initial transfer period, 2) ranking of resources that would be used in the event of a question on wound care (this time including microlearning) and 3) intent to transfer.

Pilot of questionnaires. Questionnaires were piloted prior to initiating the study. Four nurses outside of the recruitment pool and one non-nurse were asked to complete both the questionnaires and a survey about the questionnaires in order to provide feedback (See Appendix E). Pilot-testers were asked about the time it took to complete the questionnaires, if the instructions were clear, if the questions were clear and complete and if not, to describe the issue and make suggestions. Based on the feedback no new questions were added, but wording was clarified, and the sequencing of questions modified. The time to complete the questionnaires easily fell within the expected time-range. The modified questionnaires received Ethics approval.

Interviews. Participants were contacted during the sixth and seventh week after the workshop with an invitation to participate in a semi-structured interview. The goal was to obtain an interview with a total of eight participants who had used the microlearning, four from each of the two methods of microlearning delivery and to ensure representation of the nursing roles within each subunit. Given the number of active participants in the study, all eight participants who had used the microlearning were invited to be interviewed. There were five active participants from the timed access subunit and three from the repository access subunit, with nurses in supervisory and clinical roles in each subunit. Ultimately four participants agreed to be interviewed, all who had received Timed Access delivery. Two interviewees were in a supervisory nursing role and two were in a clinical nursing role.

The semi-structured interviews were guided by open-ended questions outlined in an interview guide (see Appendix D) and lasted approximately 30 minutes each. One interview was conducted over the phone and the two clinical nurses requested to be interviewed together as they worked in the same unit and had discussed the microlearning together frequently during the

initial transfer period. All participants agreed for the interview to be recorded, allowing interviews to be transcribed for thematic analysis.

The interviews provided rich, descriptive data about the participants engagement with the microlearning including the context of use, what they found useful, what they thought of the delivery method, their motivation for engaging with the microlearning and what they discussed with peers. The interviews helped to better understand data emerging from other data collection points by providing detailed examples and context.

How Data Were Analyzed

With data captured at different timepoints during the initial transfer period, a detailed description of the microlearning follow-up initiative is provided based on triangulating data from questionnaires, usage data and interviews. The training transfer models of Baldwin and Ford (1988) and Blume, Ford, Surface and Olenick (2019) guided the analysis of data to identify individual and contextual factors that may have moderated engagement with and perceived supportiveness of the microlearning follow-up initiative for transfer support. Themes arising from the data according to demographic groupings were identified first. Next, data were compared between the two microlearning delivery subunits (timed push or library access) to identify similarities and differences. Patterns and their prevalence (non-statistical) within the subunits were identified and also looked at across the case in its entirety.

Descriptive statistics obtained from the questionnaires helped to characterize the study participants and the composition of the microlearning delivery subunits. Questions on resources, environmental supports and intent to transfer repeated at different timepoints during the initial transfer period, provided a snapshot of the trends of these variables specific to this case study. Usage data (frequency, timing and duration) collected over the period of time the microlearning was available allowed for analysis of patterns related to delivery method. Usage data also were used to corroborate the self-report data collected through questionnaires and interviews. The mini-surveys at the end of each microlearning module provided a preliminary understanding of the timing of use in relation to transfer attempts, the use of other support sources and frequency of non-formal exchanges. Data on these factors were then more fully elucidated at the end of the study with the completion of the final questionnaire and interviews. The data from the final questionnaire, interview transcripts and notes were coded for emerging themes. Inferences and questions emerging from the analysis of this case are presented and considered according to the

identified guiding theoretical frameworks. Together, the analysis of these data sources provides a rich description of a microlearning follow-up initiative during the initial training transfer period and of variables that can influence the intended transfer support.

Assuring Credibility and Trustworthiness

As part of designing a rigorous case study, Yin (2009) counsels the consideration of construct validity, internal and external validity and reliability. Given the qualitative, descriptive nature of the study, internal validity becomes less relevant whereas identification of bias becomes highly relevant. Measures taken to address these considerations are reviewed here.

Bias. Researcher reflexivity is important to identify factors that may influence or skew the interpretation of data (Creswell, 2008). To address such bias, the Researcher participated in a frame interview prior to starting data collection and analysis in order to reflect on perspectives or assumptions could impact the interpretation of the data. A summary of this interview and reflections are provided in Appendix F. During data analysis, discussion and review with the thesis supervisor provided expert member-checking to ensure the rigor of this process. Furthermore, once analysis was completed, the coded data collection results and conclusions were audited by a third expert party to ensure that the conclusions derived were adequately supported by the data.

Construct validity. Evidence for the engagement with microlearning was gathered from participants regardless of when or how they used the microlearning. Participants' responses to quiz questions within the microlearning were used to test their recall of the workshop and microlearning content and complemented by the self-report data from surveys and interviews. Data were also collected at different times during the eight-week study allowing for comparison of data over time. Questionnaires were piloted prior to use in the study in order to ensure the questions and instructions were clear and could elicit the type of information required. Specifically, for measurement of intention to transfer, a set of three statements developed and tested by Gegenfurtner (2013) with an acceptable internal consistency (Cronbach's α=0.79) was selected to ensure that the intended construct was being measured.

External validity. Guided by training transfer theory, this study looks at a case of microlearning follow-up to explore if it can contribute to the support of transfer in the early training transfer period. Relevant domains of the case study results include other healthcare

Continuing Professional Development contexts where transfer support needs to be enhanced in the context of training on a complex, non-routine skillset.

The findings from this case study could guide implementation of future microlearning transfer support initiatives in a hospital setting where a trained skillset is vulnerable to decay. It also describes considerations impacting the reception, use and perceived support of such an initiative with healthcare professionals.

Reliability. To provide strong reliability, a detailed description of the case study process and data collection was retained so that the procedure for this same case study could be followed by another researcher as suggested by Yin (2009).

Furthermore, the data collected during the study are stored in an organized database. It includes detailed notes on the data collection process, initial training and microlearning. Participant questionnaire responses have been retained in digital format (paper questionnaires were scanned) along with interview transcriptions and notes. For usage data, a spreadsheet summarizing results was created allowing categorization of results by participant, by subunit and across clusters. These files are safely stored in a password protected file of a password protected computer and will be retained for seven years following the study. To ensure the confidentiality of participant specific responses, an identifying code was assigned to each participant's documentation (survey responses, interview notes, usage data spreadsheet) and used instead of their name. The code master list linking the name to the identifier is stored in a separate, secured folder and access is restricted and supervised by the researcher who is held to ethics board standards of privacy and confidentiality of both the Ethics Board of Concordia University and of the Hospital Ethics Board.

Chapter Four: Design and Development of Microlearning Follow-Up Initiative

Microlearning is a method of delivering time-limited learning content which can be understood in a stand-alone unit. This definition in and of itself does not warrant much exploration but, when microlearning is implemented as an intentional response to an identified need, guided by learning theory, then understanding its application and effect becomes of interest. This in essence, is the instructional design approach. Information on the context and need will be provided first, followed by a description of the microlearning module design and development.

Context

Nursing professional development has lagged behind continuing medical education in a formalized manner, only being required for maintenance of nursing licensure in the province of Québec since 2012 (OIIQ, 2011). Currently a total of 20 hours of continuing education are required annually, with seven of those hours needing to come from accredited training. Accreditation of training for maintenance of licensure is granted by the provincial professional licensing body. Since it became mandatory to accumulate accredited hours for maintenance of licensure, the majority of accredited training options are available through the professional licensing body as online learning or classroom training which is completed at the expense of the nurse and on their own time. Hospitals also develop and provide training that has historically taken the form of in-person training but has recently been supplemented by e-learning developed by the hospital CPD department. To have hospital training granted accreditation status, the training materials must be submitted and reviewed by the professional licensing body to ensure it meets established standards. This means that not all of the training provided by the hospital to their staff is accredited. If not accredited, it can still count toward the total 20 hours of overall continuing education, but it makes the attendance at accredited training events more competitive. Accredited training provided by the hospital is sought-after because it can be completed during work hours and is subsidized by the hospital. These practical factors can motivate attendance at accredited hospital training even in the absence of a strong interest or immediate applicability of workshop content to a nurse's day-to-day work. This, in turn, could impact the transfer of skills as well as the intention to do so. However, requests to attend subsidized training during work hours do require the nurse to submit an application to their manager presenting a rationale for attendance.

The Evidence-based Wound Care Workshop – Level 1 is a non-mandatory, accredited face-to-face workshop, that provides six hours of accredited training to those who pass the post-training test. It is held in a non-clinical area of the hospital and is open to nurses from across the adult care domains of the hospital who have received authorization from their managers to attend. The non-mandatory nature of this training is explained by the pre-licensing training of nurses already providing a foundational knowledge of wound assessment and care principles. However, as with all aspects of healthcare, there is an ever-expanding knowledge base and further specialization can be acquired in a given area. This accredited workshop has been given three times since 2016 and at the time of this study had an over-capacity attendance of 52 nurses.

The workshop objectives as stated by the Nursing Department of Clinical Professional Staff Development announcement bulletin were for nurses attending to be able to:

1) "Determine a systematic approach to adult patient and wound assessment to optimize wound healing."
2) "Compare and contrast the various types of wound dressings based on their form and function, availability and guidelines for use."
3) "Describe VAC dressing application, removal and nursing responsibilities, when caring for adult patients on negative pressure therapy." (CPSD, 2019, [workshop bulletin])

Five sequential PowerPoint presentations were delivered by Wound Care Specialists during the workshop: 1) Principles of wound healing and the wound bed paradigm, 2) management of acute and chronic wounds, 3) prevention and management of incontinence associated dermatitis and intertrigo, 4) negative pressure wound therapy and 5) assessment and prevention of pressure injuries. The intention was to have participants respond to one to two planned questions posed during each presentation using clickers but unfortunately the clicker system was not working on the day of the workshop. Spontaneous questions were also welcomed from the audience. Three handouts that could double as job-aids were provided to workshop participants on the topics of selecting a dressing, and moisture associated skin damage. At the end of the workshop, participants rounded through six interactive stations where they engaged in group analysis of case scenarios and product demos (therapeutic surfaces and new wound care products). The workshop ended with a test for accreditation which had questions related to each of the learning objectives.

Need

After this information-intensive workshop, nurses disperse and return to their units of practice where there is varying demand for wound care skills and no systematic support for transfer of their newly honed skillset. Since the information provided in the workshop was voluminous and on a complex skillset with high variability in its frequency of application, it is particularly prone to knowledge decay (Wang et al., 2013). Feedback had been received from participants in previous years on the information overload of the workshop and limited references following the workshop (L. Aziz, personal communication, November 13, 2018). Microlearning provided a way of supplementing the information from the workshop, continuing the learning experience beyond the single day and into the workplace by providing access to complementary interactive information. Of note, although the microlearning was not recognized for accredited hours of training, it could count as half an hour towards the total of reported non-accredited hours of continuing professional development required for licensure maintenance. Far from replacing the workshop, the microlearning was proposed to supplement the related formal learning event, providing a blended approach as per Emerson and Berge (2018). Additionally, the microlearning was provided several weeks after the workshop and for one subset of participants, was provided sequentially at 1-week intervals, drawing on the principle of spaced distribution of practice (Donovan & Radosevich, 1999).

Design

In order to meet the three core objectives of the workshop, three microlearning modules were designed as five to ten-minute e-learning modules. In support of the first workshop objective, the microlearning module "What's the Wound?: Wound classification and care plan" was prepared as a case study that required the user to perform an assessment, identify an error and develop a care plan to promote wound healing according to the hospital policies and procedures. To support the second workshop objective, the microlearning module "Choosing the Right Dressing: Dressing types and principles" provided an overview of the questions to ask in selecting a dressing for a wound, provided an analogy for understanding the different categories of dressings to optimize wound moisture balance and gave a reference list of categorized dressings available in the hospital. Finally, in support of the third workshop objective, the microlearning module "Negative Pressure Wound Therapy (V.A.C.® Therapy): Application and bridging technique" was designed as a video tutorial to demonstrate the optimal dressing

application technique and provide troubleshooting tips specific to nursing monitoring and management. Having three distinct microlearning modules also allowed for a variety of selection for participants in the library access subunit to choose and sequence topics in a way that was most useful for them. For participants assigned to the timed access subunit the sequencing was spread over the course of three weeks, allowing three different time-points to assess engagement with this method of delivery.

The microlearning design included transfer-supporting learning strategies for the workplace as suggested by Salas et al. (2012), specifically the testing effect and recall of prior (workshop) training. All of the microlearning modules incorporated the testing effect, with between one to three questions on the topic of wound care that required application of the information either from the module or from related material presented in the workshop. Informative feedback, a key component of the testing effect as described by Brown et al. (2014), was immediately provided once answers were submitted. With the professional adult target audience prompting the need to include experiential learning strategies (Merriam & Bierema, 2013), elements of the work environment were strategically embedded in each module to tailor the information to the case study site selected, increasing its relevance and highlighting other resources in the environment. For example, the standard care plan templates used at the hospital were recreated in the microlearning to present case scenario information and participants were asked to document portions of their assessment on portions of the hospital standard forms. The detailed content of each microlearning module will be elaborated in the 'Description' section.

The design process started with an environmental scan to identify other resources produced by the hospital on the topic of wound care that were available for reference to nurses throughout the hospital. The following resources were identified: Hospital policy and procedures for nurses on wound care assessment and topical treatment (St-Cyr, Abner & Lemieux, 2010), a job aid for identifying the stage of a pressure wound (MUHC, 2007), and an algorithm for decision making regarding the prevention and management of pressure ulcers (MUHC, 2010). To support the objectives of the workshop as well as expand upon existing hospital resources, a short-list of topic suggestions were proposed after reviewing available material along with documents form previous workshops, speaking to a nurse educator and workshop facilitator about common informational needs on wound care and drawing on the Researcher's experience in the study setting. The suggested topics were sent to the Wound Care Team who were

providing the workshop for their review and approval. While awaiting their response, best practice guidelines from Wound Care Canada (Norton et al., 2018; Orsted et al. 2018) and the Registered Nurses Association of Ontario (RNAO, 2016a; RNAO, 2016b [Video file]) were referenced to identify evidence-based core concepts as subject matter experts were not initially available in the timeframe required for preliminary design of the microlearning. In this manner, the microlearning modules were storyboarded and then reviewed by an appointed expert Wound Care Nurse who consolidated feedback from colleagues. The storyboards went through two rounds of revisions using this feedback format.

Development

After storyboarding, the microlearning was developed using Articulate Storyline 3 (Articulate Global, 2018) and published with SCORM 1.2 specifications. The video element, which will be described in greater detail below, was edited using Final Cut Pro X (Apple Inc., 2019), with voiceover created using Adobe Audition (Adobe Inc.) and overlaid on the video footage in Final Cut Pro X. Once modules were completed, they were uploaded to SCORM Cloud (Rustici Software) to test functionality and in preparation for pilot testing.

Piloting was conducted with a range of individuals and methods. Two nurses (not eligible for study participation) were asked to complete all three microlearning and were given questions to guide feedback on both content and usability. A non-clinical person, outside the field of education was instructed on doing a talk-aloud protocol and was observed by the Researcher completing all three modules to obtain usability feedback. An Instructional Designer from the hospital also reviewed the modules for usability and functionality in the testing sandbox of the hospital LMS. Based on the feedback, paths within the microlearning that resulted in 'dead-ends' were rectified and final design tweaks were made to enhance usability such as modifying an icon that was confused as a button, clarifying instructions and increasing font size. Lastly, the Researcher attended the workshop to ensure that the information covered in the microlearning was in alignment with what was presented at the workshop.

Description

The structure and content of the three microlearning modules will now be described, noting specific learning strategies. As recommended by Emerson and Berge (2018), the microlearning topics were identified clearly in the titles used in the e-mail notification and on the hosting LMS. The expected time-frame to complete each module was also clearly indicated on

the first screen (see Figure 1). This was done to favor reference of the microlearning as needed and when users had the time available to complete it.

What's the wound? Wound classification and care plan. This microlearning module was created to support the workshop objective of participants being able to: "Determine a systematic approach to adult patient and wound assessment to optimize wound healing." (CPSD, 2019, [workshop bulletin]). A case scenario was used that referenced standard hospital documentation templates (care plan worksheets and wound assessment records) to present information about plan of care for the patient (see Figure 2). Providing a variety of case examples with different presentations that may be encountered is a design strategy supportive of transfer according to Sweller, Merriënboer and Paas (1998) and is particularly relevant in the context of a non-routine skillset.

The care plan in the case scenario had an intentional error in it; misclassification of the wound. Users were asked to reflect on the plan of care provided and determine if any modifications were needed or if they would continue with the presented care plan. This strategy was used to employ the benefits of error-training (Brown et al., 2014) on a commonly reported classification confusion between incontinence associated dermatitis and Grade 2 pressure wounds (RNAO, 2016b [Video file]). The users were then asked to re-classify the wound. Once correctly classified, users then had to report their assessment of the wound in the microlearning module using a model of the standard hospital documentation templates. The correct descriptors were provided after answers were submitted to ensure immediate feedback, reflection and reinforcement of logic. The scenario required the user to evaluate the three essential characteristics required in daily wound care monitoring (exudate, pain, surrounding skin). If the user tried to proceed without assessing the patient's pain in the scenario, then they were prompted to return and explore the dialogue on pain provided in the module before being able to proceed to the next slide. An existing hospital resource, the Algorithm for the Prevention and Management of Pressure Ulcers (MUHC, 2010) was embedded in the microlearning for reference (see Figure 3). Finally, two scenario-based questions related to assessment and care plan recommendations were included with feedback based on the user's response.

Choosing the right dressing: Dressing types and principles. This microlearning module was created to support the following workshop objective: "Compare and contrast the various types of wound dressings based on their form and function, availability and guidelines

for use." (CPSD, 2019, [workshop bulletin]). The microlearning supported this objective by presenting an analogy of a scale and factors that could tip or balance it to help users identify the types of wound dressings based on their role in maintaining optimal moisture balance for wound healing. Examples of each dressing type available in the hospital setting were provided in a drop-down menu that could serve as a future job aid reference of the dressing types (see Figure 4). Users were presented with a set of questions to pose when assessing a wound to help them select the right type of dressing such as: "Are there signs of infection?" Signs of wound infection were then listed, and the user could get guidance about the dressing selection by exploring one of two buttons that were specific to care either in the presence or absence of infection. Next, the Moisture Balance Principle was introduced using the analogy and evidence for the importance of maintaining moisture balance for wound healing was presented using hover-activated buttons. The rationale for using the reveal feature to present this information was to avoid text-heavy presentation of dense physiological rationales for the approach that could result in cognitive overload and limit processing (Sweller, van Merriënboer, & Paas, 1998). Instead, the user had control of the sequence in which they explored the evidence for the Moisture Balance Principle and had the ability to choose based on interest or need.

Given that this microlearning module contained several job aids and presented theoretical concepts that could be returned to for reference, a side menu bar was integrated into the design to facilitate navigation directly to specific references as needed (see Figure 5). Two interactive drag-and-drop questions were included in this microlearning that requiring selection of the correct dressing types based on exudate level. Visual and informational cues were provided for each attempt and the user was given the opportunity to try all three options until they got the right answer (see Figure 6). Finally, the dressing care exceptions for a common subset of wounds (arterial and venous lower limb) was summarized in table format at the end with a final question requiring recall from the workshop on wound cleansing techniques.

Negative pressure wound therapy (V.A.C.® Therapy): Application and bridging technique. This microlearning module was created to support the following workshop objective: "Describe VAC dressing application, removal and nursing responsibilities, when caring for adult patient on negative pressure therapy." (CPSD, 2019, [workshop bulletin]). In collaboration with a Wound Care Nurse, a six-minute video was produced demonstrating the most current technique for negative pressure therapy application using the hospital equipment. The Wound Care Nurse

providing the demonstration talked through each step and this information was aligned with the edited footage. The video showed a standard step-by-step application of the hospital-recommended bridging technique, and corresponding basic programming of the V.A.C.® Therapy machine component. It finished by providing three troubleshooting tips for common issues but did not cover removal or scope of nursing responsibilities for dressing and wound monitoring. The focused content of this microlearning was developed with the intent to minimize extraneous load according to Cognitive Load Theory (Artino, 2008; Sweller, van Merriënboer, & Paas, 1998). Information overload can easily occur with a complex topic such as negative pressure wound therapy because of the multiple components to the dressing technique as well as the complexity of the wound being treated by this method. To avoid this, the video provided a visual demonstration with matched audio description using the actual hospital equipment and focusing on the order of placing the standard dressing material and connection to the machine.

Once editing was completed, the video was wrapped in a SCORM package to facilitate hosting on the LMS and to link it with a practice question and study survey for users to answer after the video. The practice question required users to place the dressing components in the correct order, mimicking the technique that had just seen demonstrated in the video (see Figure 7). Three attempts were permitted with hints provided if a wrong sequence was submitted. Once the correct answer was provided or the user had surpassed their three attempts, a summary of the correct sequence was provided, along with a reminder of the rationale.

Distribution

Access to all three microlearning were distributed by e-mails sent with unique URLs for each participant that directly linked them to the microlearning module. Ensuring simple access to microlearning is recommended by Eldridge (2017) who acknowledges that often hosting on an LMS can result in multiple access steps before content is launched; this runs counter to the time-efficient characteristic of microlearning.

Chapter Five: Study Results

Preview

Study participants will be described based on the demographic data collected and then subunit characteristics will be summarized. This will provide the basis from which to interpret the answers to the study questions. Each study question will be addressed in turn along with supporting descriptive data collected from the surveys, usage data and interviews.

Participants

On the day of the workshop, of the 52 nurses in attendance, 11 consented to participate in the study and over the course of the study, eight continued to actively participate. Prior to presenting the results, it is first acknowledged that those attending the workshop may already have been a non-representative subset of the general population of the nurses in the hospital as they chose to attend the non-mandatory workshop and request approval from their supervisors to attend. Second, the subset of nurses from the workshop who consented to participate were only about 15% of the class. This further increases the likelihood that those who participated in the study differed from the general population of nurses in the hospital site of this case study. To this end a detailed description of the participants and results are provided to be transparent with findings that are likely sample specific and to facilitate the identification of transferable findings.

Role and education. All participants were nurses but three of the participants worked as Nurse Professional Development Educators (nurse educators), a management role focused on supporting the professional development and practice of nursing in the units that they are responsible for. All nurse educators are required to have a Master's degree, with two having a Master of Nursing and one a Master of Education. This advanced degree of training meant they were familiar with pedagogical principles as evidenced in their responses and the terminology they used. The participation of both nurse clinicians and nurse educators within the case enhanced the ability of the small sample to still represent two distinct roles in nursing.

Work unit and years of experience. Nurses, regardless of role, can work in different clinical settings, either inpatient or outpatient. Work on inpatient settings or units are organized into shifts (day, evening, night) with teams composed of nurses, nursing supervisors (Assistant Head Nurse, Head Nurses) and an interprofessional team (i.e. physiotherapists, pharmacists, patient attendants). Nurses working in outpatient clinics work uniquely daytime hours usually in smaller interprofessional teams and may not have a nursing supervisor on-site. Nurses working

in clinics may liaise more often with resources in the community to coordinate care for patients. Among the study participants, three worked in outpatient clinic settings and four worked on inpatient units, with one nurse educator working in both settings. Each unit or clinic has a specialized care focus and the participants worked in the following care areas: Internal Medicine, Orthopedics, General Surgery, Plastics and Neurology. Participants' years of nursing work experience ranged from 4 to 28 years, with an average of 19 years' experience. The broad range of years of experience, specialties and work units helped the small sample be more representative of the wider hospital nursing population.

Subunit assignment. Prior to receiving access to the microlearning, participants were assigned to one of two subunits, distinguished by the timing of their access to the microlearning over the course of the study: 'library access' or 'timed access'. The participants were assigned to subunits so as to balance their composition by nursing roles, years of work experience and practice setting (see Table 1).

Table 1

Demographics of Participants Who Initially Consented and Actually Participated by Subunit

	Library Access		Timed Access	
Demographics	Initially Consented	Actually Participated	Initially Consented	Actually Participated
Number of Participants	5	3 of 5	6	5 of 6
Work Setting	2 Outpatient 3 Inpatient	1 Outpatient 2 Inpatient	2 Outpatient 3 Inpatient, 1 Both	2 Outpatient 2 Inpatient, 1 Both
Nursing Role	3 Nurses 2 NPDEs	2 Nurses 1 NPDE	4 Nurses 2 NPDEs	3 Nurses 2 NPDEs
Average Years of Experience	16.6	18.3	16.8	19.8
Education	2 B.N., 2 M.N., 1 M.Ed.	1 B.N., 1 M.N., 1 M.Ed.	3 B.N., 2 M.N., 1 DEC	2 B.N., 2 M.N., 1 DEC
Current Wound Care	2 Yes 2 No 1 Unknown	2 Yes 1 No	3 Yes 3 No	2 Yes 3 No

Note. NPDE = Nursing Professional Development Educator, DEC = Diplôme d'études collégiales, B.N.= Bachelor of Nursing, M.N.= Master of Nursing, M.Ed.= Master of Education.

Participants who worked in the same setting were assigned to the same subunit of microlearning delivery in anticipation of discussion and sharing amongst colleagues. Five of the participants who initially consented to the study were assigned to receive 'library access', giving them immediate access to all three microlearning at once. Of those five, three actually participated in the microlearning use and continued with subsequent data collection. There were six participants assigned to the 'timed access' subunit meaning they received access to one microlearning module at a time with access provided to subsequent microlearning at one-week intervals. Of those six, five actually participated in the microlearning use and continued with subsequent data collection.

In total, three participants who had initially consented to participate in the study did not continue to provide data after the initial questionnaire and assignment to a subunit. This resulted in less balance between the subunit assignment particularly notable in the representation of nursing role and work unit, making it difficult to identify patterns within subunits related to these demographic variables. However, across the remaining eight participants in the case there was representation of at least three to five participants for the different nursing roles, work units and current wound care status. Additionally, having a minimum of three participants in each subunit, still allowed for triangulation of patterns specific to subunit assignment.

Data were collected each time the microlearning was used, through the final surveys completed by seven nurses and through interviews with four nurses. While all active participants were invited to be interviewed, two nurse educators and two clinic nurses consented to this part of the study, all of whom had received 'timed access' to the microlearning. The lack of interview data from participants in the 'library access' subunit limits the explanations that can be provided for usage patterns unique to this subunit and affects the degree of representativeness of the case study. Although the final survey was also designed to collect data from participants who had not used the microlearning, no data was obtained from the three participants who did not use the microlearning, thus limiting the conclusions that could be made on what prevented them from using the microlearning. The results of the data collected across the case and within the embedded subunits will now be presented in answer to the established study questions.

Main Question

How do professionals in the early training transfer period following a workshop on a non-routine complex skillset, engage with a microlearning follow-up initiative, where microlearning is provided either as a timed push or by a voluntarily accessed repository?

Participants' engagement with microlearning was first assessed by whether they used the microlearning and if they completed each module. Next, the number of times they accessed each module and when and where they accessed them was reviewed. Participants' perception of the microlearning along with differences by access subunit will be discussed further in the answers to the supporting questions.

Usage. Out of 11 participants who initially consented to participate in the study, eight accessed the microlearning after receiving links to it by e-mail. Of the eight who accessed the microlearning, seven completed all three of the microlearning and one participant completed two microlearning modules but did not access the final microlearning module.

The three participants who did not access any of the microlearning displayed no demographic trend; rather, they represented a range of years of experience (from 2 to 11.5 years), work settings (one outpatient and two inpatient), roles (two nurses, one nurse educator), education levels (two B.N., one M.N.) and subunit assignment (two library access and one timed access). One reported a poor transfer work climate, indicating that they anticipated little support for transfer on return to the workplace but the self-reported intent to transfer was on par with the rest of participants who engaged with the microlearning. The only commonality between these participants was that they all provided personal e-mail addresses rather than hospital allocated e-mail addresses, however there were other active participants that provided personal e-mail addresses and still completed the microlearning. No information was provided on the reason for not continuing to participate, nor was it required.

Repetition. Once a microlearning module was sent to participants, it remained available for the remainder of the study so that participants could refer to it at a convenient time and as needed. Despite remaining available, repeated reference to the microlearning module was minimal, only occurring a total of six times over the duration of the study for all microlearning modules. The frequency of repetition for any given module ranged from two to four times and the microlearning was not always repeated in full. The shortest time spent accessing a

microlearning module was 40 seconds and occurred right after the participant had just completed the other two microlearning modules. The participant returned to complete this module in full the following week. In another instance a participant from the timed access subunit informed the researcher that they repeated the first microlearning in full because of the switch to the amended platform after the initial launch and wanted to ensure data were captured. This may have also influenced several other instances of repetition as the microlearning was used once on each platform. If repetition had been a strong pattern, the reason for it would have been important to validate to ensure it was not related to a lack of clarity in the design. The minimal repetition and the rationales that were provided do not identify an issue with content clarity. The microlearning modules that were accessed were completed in full without exception, but there was minimal return to the microlearning for further consultation.

Timing. The average time spent to access and complete the modules was 9.5 minutes, noting that the modules contained both the microlearning content and a mini-survey for study data collection. Usage started on the day of launch (both initial, Feb. 12th and amended platform launch, Feb. 22nd) and continued until March 22nd. The duration of the microlearning did not appear to hinder its use or completion but instead, in light of the completion rate, facilitated its use. This was confirmed by the survey and interview data and will be discussed further in response to how supportive users found the format of the microlearning (Supporting question D).

Location. The microlearning was hosted on SCORM Cloud (Rustici Software) which is accessible from any device with internet connectivity and the microlearning was developed on a responsive authoring tool also making it available for use on any device. However, mobile devices are still not well-integrated into nursing practice and hospital policy even discourages the use of mobile devices for reasons of confidentiality and professionalism. Even the hospital LMS, which was the originally intended launch platform, is not device-responsive. Within this context it is perhaps unsurprising that the majority of participants reported completing the microlearning at work using office-based computers, with one participant also reporting using a computer at the nursing station.

There were three participants who reported completing the microlearning both at home as well as at work. One interviewee related the use of microlearning at home to having difficulty finding time to do so at work on one occasion: "**E3:** the last one I did 'rushed' because I didn't have much time. I think, I did it at home." Only one participant, who was in the library access

subunit, did the microlearning exclusively at home. When asked if it was difficult to find time to complete the microlearning, this participant was the only one to report strong agreement with this statement. These findings show that while the majority chose to use the microlearning in the workplace, participants are willing to complete microlearning at home if it is difficult to find time at work. Access from home can facilitate engagement that might otherwise be lost.

Supporting Questions

SQ A. How will individual and environmental factors influence the use and perceived utility of microlearning? First of all, microlearning usage and completion rates were strong amongst participants overall with 87.5% of participants completing all three of the microlearning. Explanations for this usage trend were sought by examining data on individual and environmental factors for patterns that could influence both use and transfer.

Individual factors. Demographic information was reviewed, considering participants' work unit, years of experience and nursing role, but no trends were found either to explain use or non-use of the microlearning. The only unique demographic characteristic noted was that the participant who did not complete all three microlearning modules, was the only participant who had DEC-only nursing training. No demographic similarities were seen among the three participants who stopped participating after the workshop, and although they were sent the final questionnaire, no further data were obtained.

Participants' intent to transfer was measured at the time of the workshop, when microlearning was used, and again at the time of the final survey. The reason for measuring the intent to transfer at the time of the workshop was to obtain a baseline measure of a key higher-level individual variable, also linked to preceding variables of motivation and self-efficacy, which together are known to influence the likelihood to transfer knowledge into action (Burke & Hutchins, 2007; Al-Eisa et al., 2009). Intent to transfer can thus moderate the impact of the microlearning, potentially even influencing engagement with the microlearning.

Intent to transfer was assessed using a self-report measure designed by Gegenfurtner (2013) that used a five-point Likert scale to record agreement with the following three statements:

- *"I will try to use the training content in my workplace."*
- *"I feel able to use the training content at work."*
- *"The training has prepared me well for applying the training content."* (p. 203)

Overall, intent to transfer at the start of the study was found to be consistently high across participants (see Table 2), just as engagement and usage of the microlearning was strong.

Table 2

Intent to Transfer Comparison at Start and End of Initial Transfer Period

Intent to Transfer Statement	Most Frequent Response (at Start)	Response Range (at Start)	Most Frequent Response (at End)	Response Range (at End)
"I will try to use the training content in my workplace." [§]	5	3-5	5	3-5
"I feel able to use the training content at work." [§]	5	2-5	4	3-5
"The training has prepared me well for applying the training content." [§]	4/5	2-5	5	3-5

Note. Agreement was indicated on a 5-point Likert scale where 1 = strongly do not agree, 2 = do not agree, 3 = partly agree, 4 = agree, 5 = strongly agree. [§] Gegenfurtner (2013)

Of note, the partial agreement and disagreement all came from a single participant, who was a nurse educator. In both instances, where they indicated "2 - do not agree", they added a note stating that this was because there were no teaching tools. This same nurse educator reported using microlearning for teaching purposes in the final survey. The role of being a nurse educator inherently encompasses teaching as succinctly described by a fellow nurse educator during the interviews: "**E1**: Support[ing] them [new staff] through their learning and their growth as professionals and as well support[ing] the senior staff … when they orient, for their own professional growth as well if there's a new topic, new procedures, new products…" With facilitating staff learning being part of the role of a nurse educator, this is an individual factor that influences how the microlearning was both perceived and used. The responsibilities of a nurse educator motivating use of the microlearning was stated explicitly later in the same interview:

> **E1:** I did it, 1) by curiosity… And I think it's pleasant too 'cause it's short, it's sweet, it's fun […] I like to experiment different teaching approaches… I like to test it and then if it is useful for me then it may be useful for somebody else as well.

By participating in the study as a nurse educator, they could assess whether microlearning would be a resource that they could use and recommend for the nurses on their unit. In addition to the professional responsibilities, there was also personal curiosity, showing that the teaching role did not exclude participation for personal benefits. This was echoed by another nurse educator who identified their motivation for participation being for consolidation of their own knowledge following the workshop:

> **E3:** Well the thing, what motivated me, is you know sometimes at a workshop…you listen to things and you know, you have so much information, right? And then, you're not sure, if you sort of consolidated the learning. And it's by doing it, by doing it on the e-learning module, it makes you think differently. So, because you are now out of the [workshop] context and umm, you have to think it through. So…what motivated me, is wanting to know more about this topic, and again to see: 'what did I remember?'

For the nurses interviewed, when asked about their motivation to do the microlearning, the content itself was identified a motivating factor, not just acting as a refresher but extending their knowledge on the topic. It must be remembered however that the two nurses interviewed did not have the opportunity to apply the skillset and so their appreciation of the content may be more related to what it added to their baseline knowledge and even the infrequency of application. The relevance of the content to their unit of work was in fact identified as a potential moderating factor even though they completed each of the microlearning modules:

> **N4:** What I did find is I got more info, so I'm like "Great!" …and more info that I wanted that I thought they missed in that course, so that was fabulous, but on the …would I have signed up for it after if it's not in a field that's as pertinent to me on my ward or whatever, on my clinics, no.

Interest in the content was also noted as a motivation for the other nurse who was interviewed simultaneously, although similarly, they had limited opportunity to practice. Although they initially cited being motivated by interpersonal factors (having worked as a former colleague of the Researcher), they persisted with use because of interest in the content and since it was a short time-commitment.

Regarding perceived utility of the microlearning, when participants were asked what they found most helpful about the microlearning, there was a pattern in how nurses responded compared to nurse educators. Nurses tended to comment on both the content "the information

given, the repeat of the information", with the majority of them noting how it served as a "reminder of the workshop." Nurse educators remarked predominantly on the format of the microlearning "short, easy to navigate and interactive", "clear considering the content" and "they were well done."

Summary. The role of the nurse engaging with the microlearning was seen to impact their motivation to use the microlearning. Nurse educators saw the microlearning as a teaching tool and remarked on the format, while nurses appreciated the content which provided information complementary to the workshop and served as a reminder. Participants in the case study had a strong intent to transfer at the time of the workshop and similar levels at the end of the study.

Environmental factors. In order to identify environmental factors that could influence microlearning use, data were collected on work transfer climate of individual participants at the time of the workshop. This was done by asking them to select from a list of common hospital resources the ones they expected to have available in their workplace as support in applying what they had learned. At the end of the study, participants were asked a second time to indicate on the same list which transfer supports they actually had available in the workplace during the time of the case study. After a comparison of anticipated and actual supports in the environment (see Table 3), the microlearning usage data were studied for patterns related to the transfer work climate.

Table 3

Transfer Supports Anticipated and Experienced by Participants

Transfer Supports	Participants Anticipated (time of workshop)	Participants Indicated (after transfer period)
Enough Time	5	4
Encouragement from coworkers	5	2
Job Aids	5	1
Experienced Colleague to be Mentor	4	4
Not much direct support	3	2
Contact with Fellow Learners	2	4
Encouragement by Nursing Supervisor	1	0

Note. Numbers are out of a total of eight participants.

At the time of the workshop, three of the eight participants indicated that they would not get much direct support to apply the wound care knowledge back in the workplace but as per the resource list adapted from Thalheimer (2016) they "would rely on their own initiative." In fact,

this was the exclusive response of two nurse educators (a quarter of the participants) at the time of the workshop. After the transfer period when microlearning was available, they maintained the position that they had minimal support, but they did acknowledge a few additional sources of support on the list including having a job aid, mentorship from experienced colleagues and encouragement from coworkers. Despite the reported lack of support, they both reported transferring the skillset into action during the initial transfer period. Furthermore, they each used the microlearning but there was no pattern of difference in usage of microlearning, completion rate or repetition for these participants compared to their counterparts with greater support.

Participants who anticipated greater transfer support following the workshop, still engaged with the microlearning also. It was noted that nurses who worked in outpatient clinics tended to anticipate more support than nurses working on inpatient units. In fact, the clinic nurses all selected the same grouping of anticipated supports: enough time, experienced colleague mentorship, encouragement from coworkers and job aids. This anticipation of a supportive transfer environment did not discernably distinguish their usage or completion of the microlearning modules compared to those working on inpatient clinics.

After the initial training transfer period five of the seven participants who completed the final questionnaire indicated that they had fewer transfer supports than anticipated, with the exception of those who had initially indicated minimal support. Although it was an entering belief of the researcher that those with less transfer support in their work environment would be more likely to use the microlearning than those with more transfer support resources, this did not appear to be the case. However, the majority of participants had less support than anticipated and therefore the use of the microlearning served to supplement this gap.

Opportunity to transfer. The opportunity to use the skillset learned in training has been identified as an important environmental factor affecting transfer (Burke & Hutchins, 2007). Of the eight participants, the greatest variation in opportunity to apply occurred among nurses working in outpatient clinic settings who either had the most opportunities to apply or had no opportunity to apply the skillset. This is indicative of the greater degree of specialized care in outpatient clinic populations. Furthermore, as two of the interviewed nurses explained, in an ambulatory clinic, patients are only present for a few hours at a time and rarely come on sequential days. This intermittent model of care impacts the type and extent of involvement nurses can have in wound care, should the need arise.

Interestingly, the participant that had the opportunity to apply the skillset on a near daily basis still completed all of the microlearning and indicated strong agreement that the training (both workshop and microlearning) had prepared them well for applying the skillset. The two participants who did not have the opportunity to apply their knowledge also still completed all of the microlearning and reported being motivated to use their new wound care knowledge for "better patient outcomes and prevent wounds." In fact, one of these nurses saw a use for the microlearning specifically because of the rare opportunity to apply the skillset: **"N5:** To have them [microlearning] available though is…like if someone came in, to have a quick five-minute or seven-minute thing to go back and look at, that would be good." This suggests that during the initial transfer period, the opportunity to apply the training did not affect microlearning use or perceived utility. If the opportunity to apply remained scarce however, it was suggested that at a later time-point the microlearning could serve as a 'just-in-time' refresher.

During the initial transfer period, data were also collected on any additional resources used by nurses that had not been otherwise been identified. The additional resources can be classified as either independently sourced or hospital provided. The independently sourced resources were wound documentation tips found online and posted on the wall of the nurse's shared office and individual notes taken during the workshop. Hospital-provided resources that were identified were the wound care algorithm (also referenced in the microlearning), wound assessment recording form, and another workshop on advanced techniques in wound care which one study participant reported attending (it had occurred on the same day as the amended platform launch). Both nurse educators who were interviewed also mentioned contacting Product Sales Representatives, who provided in-services on various products upon request. This demonstrates that there was a variety of resources that the participants used in addition to the microlearning during the initial training transfer period, but this did not preclude the use of the microlearning.

Summary. With transfer supports being less readily available than anticipated, microlearning was used alongside other personal or external resources during the initial transfer period regardless of whether the participant had the opportunity to transfer or not.

SQ B. How will delivery method (timed push vs. voluntary pull) influence participants engagement with microlearning and why? While there was strong engagement

with microlearning across the case, the pattern of use between the two microlearning access subunits differed.

Library access subunit. Participants with library access tended to cluster microlearning use together, often completing all modules on the same day rather than spacing out the use. The only participant in the library access subunit that did not complete all three microlearning on the same day, still opened all three microlearning at once and completing two but returning to complete the third microlearning in full the following week. This same participant also reported the greatest difficulty finding time to complete the microlearning and accessed the microlearning uniquely from their home computer rather than at work. The order in which the three microlearning were completed by the participants with library access was variable. Since the microlearning had descriptive titles it is likely they were completed in the order of interest or applicability to the user's practice.

In general, participants in the library access subunit also expressed having more difficulty finding time to complete the microlearning, which may have been related to how the clustered use. Using a five-point Likert scale (5 = strong agreement, 3 = partial agreement, 1 = strong disagreement) they indicated their level of agreement with the statement "It was difficult to find time to complete the microlearning." Those in the library access subunit were the only participants to express partial or full agreement with this statement (2,3,4). In comparison, those in the timed access subunit all disagreed with this statement (1,1,1,2). However, participants in the library access subunit still made the time to complete the three modules, even if that meant doing them at home. Although no participants from the library access subunit participated in interviews, a hypothetical question was posed to one interviewee as to the anticipated effect on usage if they had received the microlearning all at once rather than as a timed push. Their response mirrored the actual usage pattern of participants assigned to that subunit and may offer an explanation that could be validated in future research:

> **Interviewer:** If you…received them say all together, like all three of them at once…how would you have used them?
>
> **E1:** I would have probably did them all at the same time (laughter)…Because I know if I don't do that, I wouldn't go back (laughter).

Timed access subunit. Participants in the timed access subunit tended to complete each of the microlearning within a week of receiving it, with a longer delay occurring in just three out

of 15 instances. Information was not collected on the schedule of participants (shift work, part-time or full-time, and vacations) which may have impacted time between access being available and actual usage. Since all interviewees were from the timed-access subunit, the spacing of the microlearning was discussed. Three of the four interviewees expressed that the one-week spacing between the microlearning delivery allowed them enough time to consolidate the information of each and that they did not feel rushed:

> **Interviewer:** …What did you think about how the microlearning was provided; so, by e-mail and over a series of weeks. Did you have any thoughts about that?
>
> **E1:** It was nice. Umm. I think it was *good* because I didn't feel rushed to do them all at once. And, it gave me time to process information on the first one. So, when I arrived to the second one, I could focus on the second one. No; it was good.

And also:

> **N5:** It was good. It was enough spacing that it wasn't like 'Oh, I've got to do it again today.' But it was oh! …you remembered from the previous… **N4:** Yup, same thing.

One interviewee however found that the spacing of the microlearning delivery was a bit close and suggested a different frequency:

> **E3:** …I thought the time-gap, maybe I would have wanted to have two weeks to do it rather than like a week. You know, sometimes you receive it, you open it, yes, I have to do it…but sometimes one thing leads to another and then the week goes by and you haven't done it. That's what happened to me, at the last time, for the last one. I felt I was rushing, but otherwise, no, like e-mailing is fine.

It is concluded that receiving timed access at 1-week intervals in the current case site, facilitated the incorporation of the microlearning into the workflow. For those in the timed-access subunit, microlearning completion seemed less onerous compared to the those in the library access subunit who reported greater difficulty finding time to complete it. Due to the minimal repetition, no clear trends regarding repetition were distinguishable amongst the subunits.

SQ C. How will participants use of microlearning interact with their transfer attempts? An overview of transfer attempts will be provided before exploring if and how microlearning interacted with transfer. Other motivations for transfer will also be discussed.

Transfer attempts. During this case study, reports of using the skillset on the job occurred more quickly for study participants than anticipated. This was in part due to half of the study participants reporting that they were currently providing wound care for a patient at the time of the workshop, a higher frequency than would be anticipated among general hospital nursing staff. This may be explained in part by the participants having chosen to be a part of the workshop and having been approved to attend by their managers after making a case for the workshop relevancy to their nursing practice. This meant that within the first three weeks following the workshop prior to the amended launch of the microlearning, a total of five participants had already applied an aspect of the complex skillset at least once. Given that transfer had already started for over half of study participants before the launch of the microlearning, it is not possible to make a link between the initial application of the skillset and use of the microlearning other than to say that despite having already used the skillset, participants still accessed and completed the microlearning. Of note, the participant who reported the most frequent training transfer (more than seven times – "I deal with wounds everyday") indicated that the microlearning would be the second resource they would use if they had a question about wound care, coming second only to asking a colleague.

Over the course of the study the majority of participants reported being able to use their new wound care knowledge for patient care more than once. There were three participants who reported using the training between two to four times, two participants reported using the training between five to seven times and one participant reported using the training on a nearly daily basis. There were two participants (nurses) who reported no opportunity to apply the knowledge. One of the nurse educators during the interview stated that on their unit of work "we may go weeks, or months, well, at least weeks without having a VAC [type of complex dressing]." For this reason, and because of their role as an educator, they described being able to seek out opportunities on another unit where they did not work, in order to practice. This shows that both work unit and nursing role impact opportunity to apply the skillset and thus transfer.

It was rare that microlearning was re-visited by participants, despite the repeated transfer attempts. This was confirmed explicitly by the two nurse educators who were interviewed (both from the timed access subunit), with one elaborating that they used the microlearning for knowledge consolidation but not in reference to a particular case or practice question:

E1: I think I was doing it within the week that you had sent the e-mails with the link. Did I use it in purpose of teaching? Probably not. As a reference, probably not. More as a knowledge consolidation. Because we had done the workshop in February and I just got the links, like end of February, March, or in March, so it's almost a month apart.

Three participants reported using microlearning close to the time they provided wound care. For one participant, they explained this was because they provided wound care on a daily basis and so the closeness of the microlearning use to wound care was incidental. Another participant, who was a nurse educator reported using the microlearning to facilitate teaching at the time of providing wound care. No explanation was provided in the third instance meaning that no pattern of interaction between microlearning use and transfer attempts could be derived due to the limited number of coinciding occurrences.

Transfer intent by the end of initial training transfer period. Intent to transfer is predictive of transfer action according to Ajzen (1991). Participants' overall intent to transfer started high at the time of the workshop and remained strong when re-assessed six to eight weeks later (see Table 2). For seven of the eight participants, their level of agreement with the statement "the training has prepared me well for applying the training content" (Gegenfurtner, 2013), where 'training' referred to the workshop and any of microlearning completed, had increased to or was maintained at five (strong agreement) at the end of the initial transfer period. Only one participant reported partial agreement by the end of the transfer period. This participant had initially reported agreement that the workshop training had prepared them well for application of the skillset however, they did not have the opportunity to apply the training.

Regarding "feeling able to use the training content at work" (Gegenfurtner, 2013) however, there was a slight downward shift in agreement at end of the training transfer period. Insight was gained from the nurse with the highest reported transfer who had indicated daily application of the skillset. Six weeks after the workshop this participant completed the microlearning all on the same day. While maintaining strong agreement with intending to use the training content and strong agreement that the training (microlearning and workshop) had prepared them well to apply the content, they indicated a different level of agreement for each microlearning module for the statement: "I feel able to use the training content at work." For the microlearning on Negative Pressure Wound Therapy, they reported partial agreement and also that they had not used this information on the job yet despite a report of daily application of

wound care skills. For the microlearning on Pressure Wound Classification and Care Plans they expressed agreement with the statement but again reported that they had not used this information on the job. For the microlearning on Dressing Types and Principles they expressed strong agreement and also reported having used the information in their workplace. This nurse worked in an outpatient clinic setting with a specific patient population that would not have regularly required all aspects of the wound care skillset covered in both the workshop and microlearning. Thus, a likely explanation of the variation in perceived utility and application in the workplace varied by the topic of the microlearning and its immediate application in the workplace with certain topics assessed as less relevant than others.

Variation in transfer intent at the time of microlearning use. Even though intentional reference to the microlearning at the time of transfer was rare, the simultaneous reporting of intent to transfer at the time of microlearning usage can still be reviewed for patterns. There was variability in the intent to transfer reported for each participant over time (see Table 4a-c). On the first use of microlearning following the workshop, five of the eight participants reported an increase in their intent to transfer. Interestingly, all those who accessed (with difficulty) the initial launch during the second week after the workshop reported an improved intent to transfer at that time compared to at the time of the workshop. The three participants that reported a decrease in intent to transfer at the time of first using the microlearning were using it in the third and fourth week after the workshop. Two of these participants had a subsequent increase in their intent to transfer measure with further uses of microlearning which was retained by the end of the study period. The time elapsed since the workshop and the initial use of the microlearning may have influenced individual participant's intent to transfer.

Transfer motivation. With no clear indication of microlearning prompting transfer attempts, participants' responses as to what motivated them to apply the skillset can provide insight into other facilitating factors. What participants almost unanimously reported as motivating them to use their new wound care knowledge was wanting to provide evidence-based practice for improved patient care (seven out of eight participants). This was even the case for the participants that did not have opportunity to apply the knowledge during the initial transfer period. It is also a motivation aligning with the organizational goals for patient care. One nurse educator exceptionally noted that work requirements were the impetus for her transfer, which could be classified as an external or controlled motivator according to Gegenfurtner (2013).

Table 4

Variations of Intent to Transfer Measure Reported with Microlearning Use Over Time

a) "I will try to use the training content in my workplace." [§]

	Participant Level of Agreement							
Time	E1	E3	E4	N3	N4	N5	N6	N7
Workshop	5	4	3	5	4	4	5	5
Week 2	-	-	**5**	W5	**C5**	-	C5	-
Week 3	-	-	-	-	-	*C3*	-	-
Week 4	*C4*	**C5**	-	-	*W4*	-	5	*C4, W4*
Week 5	**W5**	**W5**	-	-	-	-	-	*N4*
Week 6	-	**N5**	-	5	**N5**	**W5, N5**	-	-
Week 7	N5	-	-	-	-	-	-	-
Week 8	-	-	-	-	-	-	-	-
End	5	5	3	5	5	5	-	4

b) "I feel able to use the training content at work." [§]

	Participant Level of Agreement							
Time	E1	E3	E4	N3	N4	N5	N6	N7
Workshop	5	4	2	5	3	3	5	5
Week 2	-	-	**5**	W5	C4	-	C5	-
Week 3	-	-	-	-	-	C4	-	-
Week 4	*C4*	C4	-	-	W3	-	5	*C4, W4*
Week 5	**W5**	**W5**	-	-	-	-	-	*N4*
Week 6	-	N5	-	W4, C5, N3	N4	W3, N3	-	-
Week 7	*N4*	-	-	-	-	-	-	-
Week 8	-	-	-	-	-	-	-	-
End	5	4	4	5	4	3	-	4

c) "The training has prepared me well for applying the training content." [§]

	Participant Level of Agreement							
Time	E1	E3	E4	N3	N4	N5	N6	N7
Workshop	5	3	2	5	4	4	3	4
Week 2	-	-	**5**	W5	*C3*	-	**C5**	-
Week 3	-	-	-	-	-	*C3*	-	-
Week 4	*C4*	**C4**	-	-	W3	-	5	C4, W4
Week 5	*W4*	**W5**	-	-	-	-	-	N4
Week 6	-	**N5**	-	5	**N4**	**W4, N4**	-	-
Week 7	*N4*	-	-	-	-	-	-	-
Week 8	-	-	-	-	-	-	-	-
End	5	4	4	5	5	3	-	4

Note. Agreement was indicated on a 5-point Likert scale where 1 = strongly do not agree, 2 = do not agree, 3 = partly agree, 4 = agree, 5 = strongly agree.

Legend. Letter assigned if not all completed at once. C = Microlearning: "Choosing the Right Dressing", W = Microlearning: "What's the Wound", N = Microlearning: "Negative Pressure Wound Therapy". *Italic font* = decrease, **Bold** font = increase. [§] Gegenfurtner (2013), p. 203.

Summary. Ultimately, microlearning was used during the initial transfer period, with transfer getting the head start among this motivated group of participants as opportunity arose. Application of the skillset did not seem to moderate the use of the microlearning however once it was available. Although microlearning was not sought out directly by nurses at the time of application, it was still seen as contributing to their preparation. Self-reports of intent to transfer varied over time for each participant but overall remained strong when compared from the beginning of the initial training transfer period to the end. Microlearning did not appear to motivate transfer directly and microlearning use itself was related to patient care goals and professionalism.

SQ D. For users of microlearning, how supportive will they find the format and content for their application of the complex skillset? Will participants perception of microlearning support vary based on how microlearning was provided? Knowing that microlearning was not intentionally used in temporal proximity to transfer events, a number of format and content aspects of the microlearning were still identified as being supportive by users. The characteristics of the microlearning were often compared to other learning formats including the workshop, more traditional e-learning and to hands-on application of the skillset.

Format. There were three main aspects of the microlearning format that facilitated the use and supportiveness of the microlearning: Duration, digital format and interactive design.

Duration. The short duration of the microlearning was associated with its ease of use and completion by all of interviewed participants as it facilitated its integration into workflow. For one participant who was a nurse educator and who used the microlearning mostly at work themselves, they projected their experience onto future integration of microlearning on their unit:

> **E3:** Let's say we know we have wound care to cover, and let's say it's like 10 microlearnings but the nurses can go on each of their shifts … they can spend five minutes and integrate that knowledge and it doesn't take 45 minutes to do. You know? …and I think you retain more that way; by doing a little bit at a time, than trying to consolidate everything in one big module.

The time to complete the microlearning was frequently compared to the typical e-learning modules that participants had used in the past. The shorter time for completion of microlearning was seen as an advantage so that the learning could be completed in one sitting and integrated during work hours:

Interviewer: …how did you feel about [the format]? I'm seeing a thumbs up from **N4**.

N4: Thumbs up! (**N5**: Yeah, it's great) I mean it's short and sweet (**N5:** Yeah) with a lot of information; fabulous.

N5: Because a lot of the e-learnings and things like that they're … (**N4:** They're long) 40 minutes and you have to turn it off and go take care of something and come back and you don't remember what you were learning. And so, something that's like wrapped up in a five to ten-minute thing, where you can actually…

N4: Especially if you do it at work. **N5:** Yup.

Not only did it enable use at work, it was able to be completed in a single sitting, less likely to be interrupted by competing demands and allowing the user to follow the designed flow of the microlearning from start to finish, as a complete learning package. This matches how the microlearning was completed by all participants with the microlearning and associated mini-survey questions being completed in a single time-sequence.

Digital format. All of the interviewees came from the 'timed push' subunit where the digital format enabled sequentially-timed delivery via e-mail. There was agreement among all interviewees that receiving the microlearning by e-mail was not a barrier to use, instead providing straight-forward access as exemplified in this exchange:

Interviewer: And in terms of how the microlearning was delivered, so you got it by e-mail, you got it over a series of a couple of weeks, one at a time. What did you think about how it was provided in that way?

N5: It was easy. It was good.

N4: Yeah, it was easy. E-mail's easy. They were easily acc…well except the first time there but I think there was a glitch somewhere. But it was easy.

… **N5:** It was pretty easy, you clicked on the button and it opened.

This was despite the microlearning being accessed uniquely from computers and not through other devices. Another aspect of the digital design that was noted as particularly useful for someone new to the skillset, was the ability to manipulate the content pacing, allowing for efficient information processing:

N4: Which is great, having a human being giving you the course is great when you do want to ask stuff, right? But when I just want to get a technique like (clicking sound), computer and I can slow it, stop it, repeat it, whatever, it's easy. But if I want more

details or I don't understand something, than obviously with the microlearning I can't… so there's pros and cons to both but for me or whatever where I don't do wound care…I do a little bit but not a lot…the microlearning was way better. For me. For my knowledge. For me grasping the material.

This was noted as advantageous particularly as it provided the user with more control for optimal processing. The trade-off with the self-pacing however was the lack of immediate access to a facilitator who could answer questions as they arose.

Interactive design. The interactive nature of the microlearning was noted by all of the interviewed participants as a positive feature and was vividly described by one user as: "**E3:** it's almost the closest, if not the closest that we can have to the real thing … because the images are nice, everything is nicely done, so it brings you close to the clinical area."

A specific example of this was provided by the two nurses interviewed who stated that completing the microlearning on a specific dressing type made them feel better prepared to do this technique in their clinical area even though the need had not yet arisen since the workshop:

N4: The pictures. And it was simple, it took like, what, a minute? (**N5:** yeah, yup) to click on the thing and it was like 'boom' you got it. And doing it, not just having somebody say it, right?

Interviewer: Right, right. Now when you say doing it, obviously, you haven't had a chance to, on a VAC.

N4: No, we've never used a VAC, but just; in anything you have the theory, or somebody tells you but the minute you put it into action, you memorize things *way*…there's more connections being made, right? So even though I will probably never use a VAC, I know how to use a VAC now because…

N5: I mean, more after the microlearning, than there [workshop]

N4: Than there, for sure.

Interviewer: And why would you say that **N5**?

N5: It's just, it just made sense…the steps were there, it was easy to see. It was like 'oh, yeah, yeah, you do this, then you do the bridge, then you put the other, then you turn it on" or whatever the last part was. It just clicked; you know?

This response also demonstrates good retention of the information presented considering this was discussed seven weeks after the workshop and two weeks after completing the microlearning.

This interactivity of the microlearning, supported by media (images and video) and a practice question was seen as more applied than the learning on that topic experienced at the workshop. By interacting with the material in the microlearning in a way that required decision-making and application, the users were challenged to think about the information in different ways, reflecting on the information and skillset often while in the workplace setting:

> **E3:** sometimes at a workshop and…you listen to things and you know, you have so much information, right? And then, you're not sure, if you sort of consolidated the learning and it's by doing it, by doing it on the e-learning module, it makes you think differently.

Quiz questions were specifically noted to prompt reflection and further processing of the information:

> **E1:** Well it was helpful because sometimes I would go through the microlearning and I'm like: "Oh, I got the wrong answer, I was like: 'Why did I get the wrong answer?" because it's a long day, the wound care workshop. So, sometimes we need a refresher on some of the theory or the background. And that's I find it very helpful. It's like: "Oh, yeah! Now I remember why.

The completion of the questions also was noted to have facilitated recall as was intended through the testing effect with feedback that was incorporated into the microlearning:

> **N4:** Very interesting because I still remember, I remember stuff from it.
>
> **N5:** Yup. Yup. Especially because it is very easy…
>
> **Interviewer:** I'm curious, can you give me … an example that comes to mind.
>
> **N4:** Like one of the questions, I think it was on the test: 'What to put first'…like you know when you were using the suction, the steps for the foam…(**Interviewer:** right, for the VAC dressing)…it just made it easier to see it visually like that rather than to have someone at the front [during the workshop] talking for 30 minutes. It's like… step one, step two, step three, step four, step five, done.

Several features of the microlearning were cited as examples of interactivity, the video and the programmed responsiveness to user's actions which kept them engaged and perhaps contributed to their completion: **"E1:** …No I found it brilliant. I found the video was a good idea; I liked it a lot, kind of a case scenario. I like when things are interactive, and it was interactive."

> **N5:** They were even more…what's the word I'm looking for? Not advanced…like it was good; the video and then you move the little thing to there and it pops in, or the scale

goes one way or the other, like it was well done…I was expecting more just like an answer/question type of a thing, you know…it was interactive**…**Yeah, it makes it easier to learn. When you, see it and the screen reacts with you.

However, compared to actual application, one interviewee had this to say about the differences between microlearning, hands-on application and workshop learning:

> **E3:** Well there's, there's two things. Like, I realize, myself, I learn by doing…I struggle more like doing the thinking process on an e-learning module than when I am doing it. But still…it forces you to think about the process anyway, but in a different way, because when you are in a workshop, they're giving you that information and it makes sense to you when you listen to it. But, do you actually remember it, is another thing. You can understand it… and you have the big picture, but you may not be able to put all the pieces together when it is time to do it.

Microlearning, often used in the work context, provided a bridge between the workshop and hands-on application of the skillset as was intended.

Content. The content of the microlearning was viewed as "bringing back the memory" of the workshop content and at times extending it. This was facilitated by the alignment of the content with the wound care workshop and the targeted presentation of the content.

'Targeted learning.' Each microlearning module was focused on a single workshop objective and was stand-alone, not requiring a certain sequencing of completion to be understood. Again, the focused content was compared to traditional e-learning modules: **"E3:** Because what happened is that… I found that those microlearning...they're micro. So, it's not something that requires, like, 45 minutes of the nurses sitting down. And I think…it's really targeted learning …and then I don't think we would lose their interest, you understand?"

Not only was the microlearning compared to other e-learning experiences but it was also compared to the format of the workshop. The shorter, targeted information was associated with better retention of the information because the microlearning design reduced cognitive overload according to two of the interviewees:

> **N5:** Yeah and it's just they fill it [workshop] with SO much info… but this [microlearning], they were more compact and okay, on this, this, this and it was just…they were good. They were easy to, to do. They made sense.

N4: Yeah, for me too. And it's *much* easier to remember that, than a day…so it's like give me the stuff I need to know 'schlock', easily and I will memorize that quite well. But if you distract me with other things, it's harder to… (**N5:** Make sense of it all) …yeah or just what I'm gonna remember at the end. I'll only remember 20% of what you've taught me…"

Interviewer: N5, I see you nodding your head, I wonder if you…

N5: Yeah, yeah. These full workshop days or two days or whatever, one day…it's too much. It's overload. Especially for people like us who don't use it everyday, no? Like if it is something that we would see every day or every couple of days a week …but … there's too much information, for people who don't use it as often as others.

It was suggested that the targeted information was especially useful when the topic was new or one not often used by the learner:

N5: For a level 1, beginner, it is easier to just have the basic, these are the steps you need, this is the product you need, this is how it all goes together. Which is what the microlearning did…

N4: What the microlearning was. It's like these are five steps. Done. The first layer, your thing, your mousse, your bridge, your other thing, and put your machine at the other end; start it. Boom.

N5: With the short video of the one doing it.

N4: Do you know what I mean? So, there was less (**N5:** Yup) and sometimes less is better, is more when you don't know anything about anything. That's why to me it was easier, or I learn, I remember more stuff from that then there [workshop] I think.

Even for more experienced learners however who had more opportunity to practice, the focused information delivered in the microlearning was found to be supportive for information retention:

E3: You know for example, I'm just thinking of one of the modules, the microlearning modules. And I misread it okay, because I know like, o.k., you irrigate with the 20 or the 30 cc syringe and I think the answer was 'all that applied' but I just like, I say o.k., it's 30 cc with an 18 Gauge needle. And um…but it stayed with me that it's 20 OR 30. You know, but if there were so many other [pieces of] information, *maybe* it would stay with me, you know, like it would be one information part of like 30 other things that are important but, that only targeted that; When cleaning this is what you use, you know?

Bringing back the memory. The supportiveness of the microlearning was consistently linked with consolidating the learning from the workshop and facilitating recall of information. For the final survey statement "Using the microlearning helped me remember some information from the workshop" the most commonly reported level of agreement with the statement was '4 = agreement' (Range 4-5). Of note, the timed access subunit reported majority strong agreement (5) with this statement. This variation in agreement level between access subunits may have been linked to the usage pattern of the microlearning between the two subunits, where the library access subunit tended to 'binge' the microlearning while the timed access favored spaced usage. This was the only recorded difference in perception of the microlearning related to how microlearning was provided.

Three participants also reported on the final survey that the repetition of information from the workshop was reminder and identified was what they found to be most helpful about the microlearning: "**N4:** The information given. The repeat of the information.", "**N7:** Review of material from sessions.", "**N3:** A reminder of the workshop." Two of these respondents were from the library access subunit and did not participate in the interview.

All who were interviewed (all from the timed access subunit) consistently commented on how the microlearning helped them to remember as exemplified in the following statement:

> **E1:** Well it was helpful because sometimes I would go through the microlearning and I'm like: "Oh, I got the wrong answer, I was like: 'Why did I get the wrong answer?" because it's a long day, the wound care workshop. So, sometimes we need a refresher on some of the theory or the background. And that's I find it very helpful. It's like: "Oh, yeah! Now I remember why." So, I think it was just a good cue on: "Okay, I remember, that's what they talked about. This is the etiology. This is why you are doing this instead of this." It's like, it's good…"Oh yeah"…bringing back the memory of what you heard and what you learned during the workshop. I found it's good like support. Yup.

In order to serve as a reminder of the workshop the microlearning had to align with the content of the workshop. Again, this was confirmed to be the case by all interviewees, confirming the expert review for complementarity of the workshop and the microlearning conducted during the design and development process:

> **Interviewer:** And how did it fit with the workshop? The material that was covered in the microlearning, how did you find the fit?

N5: They were parallel.

N4: It fit, but…parallel other than the dressings which I thought you covered more in the dressing, like which dressing to use when a bit, because I found she rushed that a bit at the end of the course. And that is the part I would have wanted to know more about actually.

And for one of the nurse educators: "**E3:** To be honest, I found they were well done. Very well done. And they were not long. I think that too, I mean, and it was really linked to the content of the workshop, so it fit quite well."

Microlearning was recognized as support of recall and retention of the workshop content over the course of the eight weeks of the case study, during which time-frame forgetting and knowledge decay was acknowledged to have already occurred.

Finally, the perceived utility of the microlearning was also attested to when participants recommended the microlearning should be made available to other nurses, even those who had not attended the workshop and they inquired if there would be more microlearning modules available: **"E3:** I said, you know, they are very good, you know…and I think all other nurses should, would benefit from that." This was confirmed by the second nurse educator interviewed: **"E1:** …I like that approach and I think we need more of those in the institution. Because we needed quick learning and we're needing information to remember in the long term."

The format facilitated the use of the microlearning at work and was summarized in the final questionnaire as "short, easy to navigate and interactive"; even quizzes were noted as helpful. These comments acknowledge the intentional design of the microlearning that used interactive features including decision-making scenarios and quiz questions with feedback to provide recall of workshop content and facilitate retention according to Salas, Tannenbaum, Kraiger and Smith-Jentsch (2012). As for content, it was seen as reflective of the workshop, clarifying and reminding users of the skillset while prompting them to think further about what they had learned. When asked if there was something that they would change about the microlearning two participants specifically commented 'Have more' and the rest stated that there was 'Nothing' they would change**.**

SQ E. How will participants use of microlearning impact their use of other sources of support in the environment? Will microlearning prompt non-formal learning among colleagues? To assess the use of resources in the work environment, at the time of the workshop,

participants were presented with a list of the most common resources available in the hospital context and asked to rank them in the order they would consult them if they had a question about wound care. Participants were asked again after six to eight weeks to rank the same resources to which microlearning had also been added. The ranking of resources both at the time of the workshop and after the initial transfer period were examined for changes and patterns according to demographics, nursing role, work unit and the method of accessing microlearning.

The most frequently top-ranked resources were asking a colleague a question and looking on the intranet for policies and procedures. Initially, a difference was noted according to nursing role where nurses tended to prefer asking a colleague first and nurse educators looked on the intranet for policies and procedures first. Following the initial transfer period, these two resources maintained their favorable rankings but this time with asking a colleague being clearly favored by the majority of participants regardless of their nursing role.

The ranking of Wound Care Specialists increased over the course of the study; while initially most frequently ranked as the fourth resource, by the end of the transfer period they were more frequently ranked as the third resource that would be consulted. This may have been influenced by the review of indications for wound care consult during both the workshop and in the microlearning modules. Access to Wound Care Specialists could however be influenced by the unit of practice of nurses with two outpatient clinic nurses reflecting:

> **N4**: I mean, I know we have those nurses there in the Wound Care, but …
>
> **N5:** …we're at the (hospital satellite site) and we don't have access to anybody or anything at the (main hospital site) …
>
> **N4:** And they also said that they are very busy, right? So, unless it is something, like they're not just going to pick up and answer a short little question about a little thing, right? There are only one or two, no two of them right, I think.
>
> **N5:** Three, I think there are three.
>
> **N4:** Unless we had a huge [thing]…So I've never felt comfortable actually reaching out to them. (…)
>
> **N5:** But also, our patients are here for a few hours. And we can't get them to come the next day, the patient is not here.

This diminished access to a core resource may have been an additional motivating factor for these two nurses to attend the wound care workshop even though they rarely cared for patients requiring the skillset.

The ranking of consulting an Assistant Head Nurse remained largely consistent throughout and there was a dominant pattern among participants working in outpatient clinics who consistently ranked Assistant Head Nurses as the last resource they would consult if they had a question about wound care. This may be due to the structure of nursing roles in an outpatient clinic which does not always include an on-site supervisor.

When microlearning was introduced into the list at the end of the study, its ranking appeared to split with near equal frequency between either the second ranked resource to consult or as the fourth resource. To contextualize the ranking of microlearning, this placed it on par or close to looking for policies and procedures on the intranet and the majority of respondents ranked it above consulting a wound care specialist, doing an internet search or asking their assistant head nurse for help. There was no strong pattern to explain the split in microlearning ranking when reviewed according to nursing role, work unit or delivery method of microlearning.

Participants were also able to add resources to the list, if they felt a commonly used resource was missing; only two additions were made over both time points. One participant added Nurse Educators as a resource, and this participant was a Nurse Educator. The second resource identified was the hospital wound care algorithm which was included within the hospital policies and procedures and also was provided as an external link in the microlearning.

The acknowledgement of nurse educators as sources of support was limited in that it emerged only from participants who were nurse educators themselves. The one nurse participant who worked on the same unit as a nurse educator participant did not indicate nurse educators as an additional resource that they used. One explanation for this is the autonomy of nurses, especially when the nurse educator is new to them or is not present in their immediate work area as illustrated in the following interview statements: "**E3: "**Nurses are fairly autonomous in what they're doing. They don't solicitate me all the time and I am new." This was what was echoed by the two nurses interviewed, although they worked in a separate department:

N5: Maybe the nurse educators might have a little bit more info on what's available on the units because I think that's what, part of their role is, but I haven't really ever used them, really, to be honest…

N4: No, me either. We usually, resolve our stuff, usually.

In terms of the effect of microlearning on the use of other resources, there were simultaneous fluctuations in the ranking of other resources during the time that the microlearning was available, but no evidence supporting that these changes were directly due to microlearning. Only one example was given of microlearning directly prompting use of another resource because of a question that arose:

E1: Honestly, I don't remember which one of the three microlearning. I was like: "That's not what I was thinking…" (laughs). I mean it could be me, just my perception as well, you know? When you receive information, you process it differently; …but what I remember is: "Okay, why is this one *best*?" And that I had to go back into my notes … the notes from the workshop that I had taken, and see if I can answer, or why this product, or this way of treating the wound was better than this way of treating the wound.

Otherwise, there was no evidence for microlearning directly increasing or decreasing the use of other commonly available resources during the study but rather the microlearning was integrated and was used simultaneously with the other resources.

Non-formal learning. The majority of participants (six out of eight) reported discussing or sharing the microlearning with colleagues and one participant specifically indicating that they used it for teaching purposes. Two nurses indicated that the microlearning specifically had prompted them to discuss what they had learned about wound care with colleagues. The interviews provided more details as to what was shared about the microlearning which included discussion of both the format and potential for future use:

E3: I shared it with one of the other educators, like how nicely done they were…And one of the Assistant Nurse Managers too, because I thought she was part of the study and I said 'oh, did you participate in the study' and she said 'no, finally I did not' and I said, you know, they are very good, … and I think all other nurses should, would benefit from that.

Fellow participants who worked on the same unit also prompted each other to complete the microlearning and compared results:

"N5: We reminded each other to do them.

N4: Yeah, it was like: '**N5** do your thing. do your homework.' (laughter)."

The use of the microlearning itself was also talked about with colleagues who were not participating in the study and had not attended the workshop, speaking to a culture of information sharing which the microlearning became a part of:

Interviewer: Actually, did you talk to anybody else about it? And there is no right or wrong answer to this, let me just say.

N4: Oh yeah.

N5: Everybody knew we were doing them.

N4: Well we share. But even the wound care thing, not even just the… we always share everything.

The two participants who did not report specifically sharing or discussing microlearning during the initial transfer period (representing both access subunits) had ranked microlearning as the second resource they would refer to if they had a question about wound care and one had suggested the microlearning should be made available to other nurses outside of the study asking when this might be the case.

Summary. The microlearning was noted as easy, interactive, and helpful for recall. Some nurses reported that it extended their knowledge on the skillset and for one nurse with little opportunity to practice, they reported the microlearning made them feel more ready to use the skillset than after the workshop alone. Microlearning was used for teaching by one nurse educator. There was no evidence of the microlearning being used as a job aid for just-in-time learning other than by one nurse educator to facilitate teaching just prior to application of skillset. Microlearning was described as challenging the user to think differently and in a more applied way than in the workshop, closer to actual hands-on application. Participants discussed the microlearning with colleagues and recommended it for future continuing professional development.

Chapter Six: Conclusions, Limitations and Suggestions for Future Research

Conclusions

With discussions of microlearning abounding in professional training forums and trend predictions touting its ever-increasing application, a descriptive case study of microlearning designed for transfer support of a complex skillset has not been provided in the literature. What this study is able to provide is just such an example of a theoretically-grounded implementation of microlearning in an applied workplace setting. Microlearning was designed to consolidate information delivered at a workshop on a complex skillset and was made available to nurses after return to the job in two different ways: library access and timed access. Study participants were a small, self-selected sample of nurses with high intent to transfer who were practicing in weak transfer environments. Admittedly, this sample limits some of the practical transferability of the results of this case study however, the sample still represents a range of nursing roles, work units, and work experience both across the case and within each embedded subunit. The detailed description of the participants and context should be kept in mind while considering the following conclusions to support relevant conceptual transfer.

Although there was strong usage exhibited across the case study, participants that received the microlearning by timed-access delivery reported that it was easier to find time to use the microlearning and also reported stronger agreement that the microlearning use helped them to remember information from the workshop. There were also differences in usage patterns depending on the type of access participants had to the microlearning. Those receiving library access tended to use the microlearning in clusters rather than spread out over time, even though they were aware they would have access to it for a month. The lack of participation in the interviews of those who received library access might have been related to the clustered usage approach. If the microlearning was viewed as a task to be accomplished, more prompted by a sense of duty or motivated by adding to time accumulated for continuing professional development hours, the extra step of an interview would have been seen as less relevant or beneficial. Additionally, if the clustered use was prompted by a concern about time and not having other opportunities to return to complete it or to make time for it in the future, this may have spoken to their context of practice and the time limits that could also have constrained their participation in the interview that was projected to take 30 to 45 minutes. During interviews with participants in the ‘timed access’ subunit the engagement with the follow-up microlearning was

reported as fostering active processing of the workshop information and consolidating knowledge in a way that was closer to real world application.

The data suggest that microlearning, when deployed as follow-up support to workshop training can help nurses who have a strong initial intent to transfer and work in a moderately weak transfer climate by continuing the learning interactions once back in the workplace and during the time of initial transfer. Specifically, engagement with the microlearning was reported as supporting processing of the information required for optimal application of the skillset. The implications of these finding for practice and research will now be considered followed by limitations of the study and recommendations for future research.

Implications for Practice. Eschewing the unfounded goldfish attention-span argument (Quinn, 2018) and rather recognizing the potential of microlearning to be thoughtfully used for training transfer support in a complex care practice setting, a case study was designed to inform evidence-based practice. Relaying findings from empirical data can help to move microlearning from the flashy trend pile, to that of a better understood teaching format for judicious use by instructional designers. Here are five take-aways points for practice, bearing the constraints of the sample in mind:

Microlearning can bridge theoretical knowledge and application. Microlearning can be used to place skillset information and practice closer to the context of application. Microlearning was vividly described in this study as being the 'closest to the real thing', bridging the theoretical and passive learning in a workshop with the hands-on practice. It re-introduces information by requiring learners to recall and think through how they would apply the information, priming them for action at the bedside. Although the task of recall is well known to support information retention, it is not always evident to the learner when it is most effective to engage in recall. Therefore, the recall tool must be interesting, interactive and streamlined and ideally sent in a spaced fashion, as best suited to the topic and work environment, in order to encourage spaced repetition for optimized information retention.

Microlearning's advantageous 'in-between' role was also manifested in the wide-ranging characteristics of the participants that used it. Users ranged from having little experience and opportunity to apply, to those with many years of experience and frequent opportunity to apply. Regardless of the level of experience, the microlearning was evaluated as engaging and useful for retention, teaching or skillset application among this sample of motivated users. Content

relevance to the user's specific area of work did however impact the participants feeling able to use the training content. Consolidation of a skillset is typically achieved through application, but when frequency of application is variable or may be limited to one aspect of the skillset, resources are needed to round out the practice and consolidate the investment in learning.

Microlearning can be designed for engagement and transfer. The microlearning was conscientiously designed with adult learning principles in mind. Questions were posed and immediate feedback given with a detailed answer, utilizing the "retrieval practice effect" (Brown et al., 2014). Video and images were identified by users as supporting understanding and bringing them "closest to the real thing." The pacing of the material including video content could also be controlled by the user to optimize their processing of the information. Streamlined information on a clearly defined topic was presented in each microlearning module, referencing specific tools and materials in the learner's environment required to perform the skillset. The targeted information was noted as particularly for those who had limited experience with the topic as it helped to reduce extraneous load (Sweller, van Merriënboer, & Paas, 1998), allowing the learners to focus on consolidating one core objective-focused concept at a time.

The information was also presented in ways that required interaction and decision-making with responsive elements providing cues and feedback. It was the active, responsive design that was reported as making two interviewees feel as if they had applied the new technique, and more confident in their capacity to do so, even though they had not yet used it with a patient. Even participants experienced with wound care reported that the information was useful, providing clarity on the theory and due to case scenarios that require thinking through the application of the theory. The feedback received from participants on the format and what they viewed as helpful affirmed the importance of interactive design to prompt reflection, processing of information, recall. The review of content after the workshop, through the use of microlearning, challenged the user to think about the skillset while in their work context.

This designed format can be both efficiently produced and used in a resource constrained setting with the goal of optimizing the efforts that have gone into a resource intensive full-day workshop. The less than 10-minute length proved compact enough to be incorporated into nurse's workflow on a variety of work units, both inpatient and outpatient. Microlearning can still be produced in a shorter time-frame than the traditionally longer e-learning format. As self-

contained units, they may be repurposed for various teaching applications, however, the use of microlearning must be considered and grounded in theory in order to have impact.

Users engage with microlearning regardless of immediate application. An oft-used argument to promote use of the microlearning format for training development is that it is compact enough to be referenced as-needed on the job. However, there was little evidence of this type of 'just-in-time' behavior in the current case study. Despite the accessibility and the short duration of the microlearning, only one participant indicated using it for 'just-in-time' use but not for their own personal reference. Rather, it was shared by a nurse educator with nurses on the unit for teaching at a relevant moment; this could be considered 'mediated just-in-time' usage. This demonstrates an unintended but interesting use of microlearning which extends its use beyond solely independent access to that of a mediated resource that can be referenced during facilitated teaching sessions. Having microlearning available over time may not be sufficient to prompt use in the moment of need without additional reminders of its availability such as promotion by nurse educators, e-mail reminders and continued discussion among colleagues.

Another explanation for the lack of just-in-time referencing of the microlearning could be the duration of the case study meaning that microlearning completion was recent enough that participants did not feel the need to repeat the microlearning for recall just prior to application. In terms of timing, the duration of the microlearning itself, being approximately 10 minutes, may also have contributed to the lack of repetition; although easier to integrate into the workflow than a traditional long-format e-learning, it still required a time investment of more than a couple of minutes which may have made it less likely to be repeated than something than microlearning that was five minutes or less.

Conversely, the microlearning was used even by those who knew they would be unlikely to apply the skillset in the near future; these users of the microlearning could be called 'just-in-case' users. It may be asked why nurses would participate in a workshop or further training on a topic they were unlikely to apply in the foreseeable future. Multiple motivations could prompt such behavior in the professional and hospital context. First, the microlearning could be counted towards the total of continuing professional development hours to maintain licensure, in the non-accredited hours category. Additionally, the participants could have felt a sense of duty to complete the microlearning, having committed to the study and some having worked with the researcher previously. Access to other resources may also have influenced the microlearning, for

example, there was less access to Wound Care Specialists and supervisory support reported by nurses working in outpatient units, where the nurses functioned quite autonomously. This might have favored the use of the available microlearning support in an outpatient context where there were fewer other resources available. Furthermore, in a workplace such as a hospital, the importance of being prepared for the unexpected is paramount regardless of how frequently a specific skillset is used; it is encouraged, even required to have a breadth of knowledge in order to be an excellent clinician. Nurses also reported a culture of sharing information and they ranked colleagues as their number one resource in the event of a question about wound care. In team-based work such as nursing, even if you are not the one providing immediate care to the patient requiring wound care, you may be the one asked.

Binge-use or a steady-diet is influenced by the timing of access to microlearning. With evidence of a tendency in this case study to complete microlearning back-to-back when access was given all at once, it should be considered whether such usage is desired or to be avoided when providing microlearning. Two participants specifically mentioned that they used the microlearning for review to help with retention of the information but that they had not returned to it repeatedly for consultation. So, if microlearning is used for knowledge retention, then this study suggests that it should be provided in a way that optimizes retention through spaced learning, a well-supported approach reviewed by Pashler, Rohrer, Cepeda, and Carpenter (2007).

Binge usage takes away from the focused nature of the microlearning. The learning can be drowned out by other elements of the learning before being consolidated. The ability to space out the learning through timed delivery will facilitate use, perception of use and retention of the information as it is not diluted with competing content. While the optimal spacing will vary by work context and schedules, in the context of this case study, optimal spacing is recommended to allow for at least one week in between learning sessions. If more microlearning modules were planned for sequential delivery, a longer spacing between access times would be recommended to avoid a build-up of incomplete microlearning and to ensure that variations in schedules are accounted for.

A digital format facilitates access, but additional variables may influence flexible use. In a work setting where nurses are often in action away from a computer and other connected devices while providing care to patients, delivery by e-mail was still a viable means of providing access to the microlearning. It was a way of informing the nurses of the availability of the

microlearning at a time when they could potentially access it immediately since they were already at a computer station and had found time to check their e-mail. Access to the microlearning was sent to the e-mail address provided by the participant.

Type of e-mail address. The e-mail addresses were a mixture of hospital assigned e-mails and personal e-mail addresses. Although those using the microlearning did so from a mixture of personal and work e-mail addresses, the three participants who did not use the microlearning had all provided personal e-mails. Using work e-mails may facilitate reference in the workplace, while using personal e-mails may lend itself to greater flexibility as to the location of reference but it may also lead to the resource being ignored as it mixes the personal and the professional. Consider what type of e-mail address is being used for distribution of the resource or notification of the resource as this could influence where, and even if, the resource gets used.

Type of device used on the job. Although the microlearning was accessible from work, home, or anywhere in between with connectivity, it was still used predominantly at work and exclusively on computers. The fact that the microlearning was completed exclusively on computers despite being available on any device with internet connectivity speaks to the lack of integration of mobile devices in nursing practice in this context. Certainly, the use of mobile phones in the workplace for professional duties is still limited and even discouraged in nursing, due to necessary restricted access to patient data, concerns about infection control and professionalism. Similarly, in participatory research in the manufacturing industry, Schactner (2005) also noted the constraints for mobile microlearning in this different hands-on industry. Just because training can be made available across devices and this theoretically should enhance engagement, the degree to which this accessibility increases usage is strongly impacted by the work environment.

Platform accessibility outside of work. What did facilitate completion of the microlearning was the ability to access the cloud-based learning platform from work and outside of the workplace. While the majority of participants were able to complete the microlearning at work, when they did not have time, they resorted to completing the microlearning from home. Familiarity then of the work environment is important when selecting the core features of a design for instruction, including the platform in which it should be hosted and how the users are most likely to access it.

Although the results of this study support that microlearning holds promise for supporting transfer this needs to be evaluated in other contexts and with a larger sample of participants.

Implications to Research and Theory. Having acknowledged the importance of designing microlearning according to learning theory principles, how does this case study extend or validate theory for instructional design practice?

Microlearning can be designed. The question was posed by Kerres (2007) whether microlearning was a challenge to instructional design. This case study is congruent with Kerres' (2007) conclusion that instructional design of microlearning can be used to situate it within a network of relevant resources in the environment that encourage employee-driven continued learning. The microlearning in this study referenced documentation and decision-making job aids already available in the work setting and since it complemented the prior workshop training, nurses both engaged and persisted with usage of the microlearning. This way of incorporating microlearning into instructional design to complement a formal learning event is supported by Shank (2018) as well as Hug and Friesen (2007) who present microlearning not as a replacement for in-depth training, but rather as a complement to other training components, embedding microlearning in a broader transfer design. The supportiveness of this approach was particularly apparent for those who received the microlearning as a timed push according to the principle of spaced repetition (Donovan & Radosevich, 1999). The majority of the body of evidence supporting the effect of distributed practice has been evaluated with simple rather than complex tasks and motor rather than cognitive skills, according to Donovan and Radosevich (1999). Bearing in mind the select group of participants, the effect of the spaced microlearning on recollection of the workshop information in this case study provides an example of how this design can be supportive when acquiring a complex skillset with mixed motor and cognitive components.

The incorporation of evidence-based learning strategies into the microlearning design, as recommended by Salas, Tannenbaum, Kraiger and Smith-Jentsch (2012), were also noted by users as helpful to their engagement and processing of the information. Users described helpful characteristics of the microlearning that corresponded to the intentionally planned elements of: recall and testing effect with feedback, reducing extraneous load and applied case scenarios. Learning strategies can be effectively applied in a small package. In fact, microlearning as a training format must use and be applied according to learning theory in order to have any impact

on transfer according to Alvarez, Salas and Garofano's (2004) Integrated Model of Training Evaluation and Effectiveness. They state that it is when principles guide the use of a training technique that it then falls into the category of 'training characteristics', one of the three main categories that can directly influence both training effectiveness and transfer.

Designed microlearning can be used to enhance the transfer climate. This study adds evidence for the potential of thoughtfully designed microlearning to be used as transfer support, if it is in alignment with a formal learning event and sequenced after participants' return to the workplace. It was in this context that the current study demonstrated learner engagement with the microlearning follow-up, prompting workshop content recall, situated practice, and discussions among colleagues. Further research with a more quantifiable skillset would be necessary to measure microlearning's impact on performance of specific aspects of the complex skillset.

According to Burke and Hutchins (2007) support from colleagues and supervisors are significant but distinct parts of the overall transfer climate. In this study, experienced colleagues and fellow learners were the most frequently identified resources in the workplace but there was minimal support from supervisors reported and job aids were less available than anticipated. Overall this depicts a moderate to weak transfer climate where support for transfer relies predominantly with colleagues. This may have favored the use of the microlearning as a way to supplement supports in the environment. When compared to other common resources available in the work environment (that were not people), microlearning was often ranked on par with the hospital policies and procedures as a resource and more likely to be used than an internet search by the majority of participants. Of note, the microlearning was also used by nurse educators who work in a supportive capacity for other nurses. This points to the use of microlearning for either independent use or as a resource for educators to facilitate training with nurses. As an added resource that was used in the work environment alongside other resources, microlearning was well-used, serving to improve the transfer climate.

In terms of microlearning impact on training transfer, drawing direct links to action were limited by the study design (see Limitations) but participants' intent to transfer, measured at the time of microlearning use, which was strong at the start, was maintained or improved for the majority of participants over the course of the study across all aspects of the measure. This strong intent to transfer was even true for nurses who had limited opportunity to apply the skillset.

Microlearning use in the workplace can foster non-formal learning exchanges. The strong majority of participants reported discussing the microlearning with colleagues, with specific reports of microlearning use prompting conversations in the workplace. It was shared by the majority of participants in instances of non-formal learning in which they discussed the content, their results, completion status and the novel format, recommending that there should be more such microlearning made available to themselves and their colleagues. Returning to Eraut's (2000) "typology of non-formal learning"(p. 115), such discussions prompted by the microlearning use can be classified as "reactive learning" (p. 115) as the level of intent to learn by the participant's colleague engaging in the discussion may be quite variable and arises in response to the microlearning use by another. This demonstrates that microlearning can have broader impact beyond the immediate user when they are engaged and have a high intent to transfer. With colleagues being ranked as the number one resource in the event of a question, and interviewees describing an environment where knowledge and resources are shared within teams, microlearning holds promise to foster further exchange, an appealing prospect in a resource-limited setting.

Support for fluctuating intent to transfer as predicted by the Dynamic Transfer Model. Blume et al. (2019) predict that after each transfer attempt, re-evaluation of trained knowledge, capacity and intentions occurs. By collecting data about individual participant's intent to transfer over time, a self-comparison can be made across different time-points. In this case study, such fluctuation in the intent to transfer measure was evidenced for all participants over the course of the initial transfer period. Specifically, in the third and fourth week after the workshop, there was a trend of lower intent to transfer scores than at the time of the workshop. There was no common feature among those reporting this decreased intent to transfer in terms of opportunity to apply, work unit, transfer climate or nursing role, leaving the timeframe as the only connecting feature from the data collected. This timeframe is consistent with what Wang et al. (2013) reported in their meta-analysis of skill decay in organizational training that skill decay was often prevalent between two to four weeks post-training. Following this nadir point in the present case study however, all of the participants subsequently reported an increase in intent to transfer with the exception of a single participant who maintained straight 'agreement' for the remainder of the study across the subsequent reporting periods. Of note, this participants' agreement that the training had prepared them well for application remained consistent since the time of the

workshop and throughout the period of microlearning engagement. The fact that the pattern of decreasing intent to transfer fell during a point at which knowledge decay was likely, may be an example of the challenge of active recall when knowledge decay has set-in, as explained by Brown, Roediger and McDaniel (2014). Subsequent to recall and practice, intent to transfer reports in the subsequent weeks improved.

These fluctuations in intent to transfer may exemplify the re-evaluation process as triggered by the most recent application of the skillset as proposed in the Dynamic Transfer Model (Blume et al, 2019), but also may have been triggered by the use of microlearning, a relevant transfer variable in the environment. Since the intent to transfer measures were completed at the end of each microlearning module and the microlearning was rarely used on the same day as a transfer attempt, the measure may be most reflective of the impact of the microlearning as it was viewed as a form of practice by the users. This suggests that the microlearning can supplement the reflection and re-evaluation cycles predicted by the Dynamic Transfer Model (Blume et al., 2019). Overall however, in the presence of microlearning the intent to transfer was maintained at a high level or increased in the majority of cases by the end of an eight-week time period. With Blume et al. (2019) calling for research to "examine how individuals seek out opportunities to maintain and further develop their KSAs [Knowledges, Skills, Attitudes] as they are waiting for a relevant transfer opportunity" (p. 280), this case study of microlearning offers one such example in the context of a complex skillset with application outcomes affecting patient's health.

Limitations

Design limitations. The case study design, while providing operationalized examples of the microlearning follow-up to training within a specific context, does not offer generalizability of the findings (Yin, 2009). However, the concepts arising from an adequately described case study can be transferable (Green & Thorogood, 2014) by prompting a consideration or insight among practitioners who are considering the use of microlearning to support transfer of a complex, intermittent skillset among healthcare practitioners in the hospital setting and who take into account the specific context in which the results of this study are presented. The findings also provide interesting consideration for further research that should be conducted in other professional contexts, with larger samples and over a longer period of time.

The small number of participants in the study may have limited the ability to clearly distinguish patterns related to individual and environmental influences on usage, intent to transfer, and impact on the use of other supports in the environment. Also, there was less demographic and subunit representation across the data collection points than had been intended in the design. The participants who agreed to be interviewed were all from the same microlearning access subunit 'timed push' so there was descriptive detail lacking on the experience of participants who had library access. However, the main distinction between the subunits from the data collected through surveys and over time was the usage pattern of the microlearning, with otherwise similar engagement and supportive elements reported from the microlearning use. The absence of data from participants who did not engage with the microlearning however, leaves a gap in understanding what factors contributed to prevent use on the individual, environment and design levels.

The duration of the case study (eight weeks) may have limited assessment of repetition and just-in-time referencing that could occur over a longer stretch of time given the intermittent nature of wound care in many clinical settings. It had been mentioned by one interviewee who had not had the opportunity to apply that they could see using the microlearning in the future as a reference, if and when the need to apply the skillset arose. Also, a longer period of data collection would have helped reduce any impact of work scheduling on timing of the usage of the microlearning such as what shifts participants were working or if they took vacation during the time of the microlearning study.

Finally, given the unpredictable occurrence of application of the wound care skillset and the disparate work units on which participants worked, data on transfer and the intent to continue transfer were limited to self-report.

LMS limitations. The hospital Learning Management System (LMS) proved insufficient to coordinate straight-forward and sequential access to the microlearning. This led to an unanticipated switch of learning platforms which had to be approved by both Ethics Boards and required a second launch to ensure users had access. The microlearning which was produced with Articulate Storyline 3 (Articulate Global, 2019) and published with SCORM 1.2 parameters was not read to the same level of detail on the amended SCORM Cloud platform. For example, data were not available on each slide interaction (time spent per slide, sequence of button use) unless it contained a 'reporting' quiz or survey question. The detail of question responses was

also truncated in SCORM 1.2 reporting, meaning that only the first letter of the answer was reported in SCORM Cloud compared to the original LMS which reported the full answer. Since responses were not assigned a letter (a, b, c, d) or sequence in the original design, the first letter of the phrase was used and this was not always a unique identifier (i.e. 'in the last two weeks', 'in the last three days' were both indicated as 'i'). This only impacted the distinction of how many days since the time of report the learner had applied the knowledge in the workplace, although it was still possible to know if the microlearning and transfer occurred on the same day. The other items this impacted only affected the granularity of the incorrect responses selected by users in some cases, however, this was not an essential data point for this study.

Launch delay. The delay in reliable access to the microlearning after the unsuccessful initial launch and subsequent switch of platform may have contributed to the attrition of three participants. The delay of access to microlearning also meant that those in the timed access were delayed in getting full access to the microlearning by two weeks. However, the second launch occurred three weeks after the initial workshop, still within the 14-28 days noted by Wang et al. (2013), in their meta-analysis of skill decay, as the interval after training when decay starts to amplify. This interval also provided more time for application of the skillset prior to accessing the microlearning and may have diluted to ability to detect the interaction between microlearning and transfer attempts. Additional correspondence with study participants was required to inform them of the delay and when re-launched. These communications may have served as a small prompts or reminders of the workshop.

Potential interpersonal bias management. While the first-hand knowledge of the context aided the Researcher in the design of the microlearning and contextualized analysis, the prior work experience of the Researcher at the study site meant that two of the participants were former colleagues. As with all participants, they were informed that participation was voluntary and that there was no obligation to continue participation. At the time of the interview, to which they also consented, the Researcher expressly acknowledged their prior working relationship and asked them to assume the interviewer was unfamiliar with their context and to not filter their responses in order to be 'kind'; rather their honest, unfiltered answers were sought by the Researcher to optimize integrity of the data.

Furthermore, prior to the development of the microlearning, the Research had spoken with a nurse educator who was helping to coordinate the workshop in order to review possible

topics for the microlearning that would align with the workshop and the practice support required by nurses. This nurse educator subsequently expressed interested in participating and consented to participate in the study unprompted by the Researcher. They were the first to complete the microlearning and identify the initial launch problem. While they completed the final survey, they did not participate in the interview. Despite this advanced knowledge of the study, the responses by the participant did not vary much from any other user and did not deviate from the trends other than to clearly identify at the time of the initial questionnaire the lack of teaching tools impacting their feeling able to use the training content at work and prepared to apply the training. On the final questionnaire, their response to these to items had shifted from disagreement to agreement.

Suggestions for Future Research

Having provided the analysis of this case study of microlearning application for transfer support of a complex skillset training, what can be built upon by future research?

Further comparison of the microlearning access type (timed push or library access) with a larger sample size with a more representative sample of the general nursing population within the selected context would help to establish the tendency seen in this case study of binge usage within the library access subunit. If this usage persisted, the impact on perceived ease of use and the impact on information retention should also be verified with a larger sample and in different contexts. A larger sample would also demonstrate a level of usage and engagement that would be more representative of the broader population and should include data from those who had low to no engagement with the microlearning in future studies to better understand barriers to use.

A longer timeframe for data collection would also help to confirm another surprising finding of this case study, that this format of microlearning accessed by e-mail to nurses was not used for independent just-in-case reference. If so, the changes in format or access that would facilitate such usage in the hospital care context should be explored.

In future studies, data from a control group who had participated in the workshop but not had access to the microlearning would help to distinguish the impact of the microlearning from other environmental supports in the system, sustained strength of intent to transfer and differences in transfer rate with and without microlearning support. With initial confirmation from this study of variation in intent to transfer for individuals over the course of the initial training transfer as proposed by the Dynamic Transfer Model (Blume et al., 2019), further

research should focus on fuller descriptions of the factors influencing transfer at multiple time-points during the initial transfer period, including transfer support initiatives such as microlearning-mediated practice in follow-up to training.

Finally, knowing that microlearning has potential for post-training transfer support, particularly for those without prior experience of the skillset, use in a pre-workshop context as a primer for deeper learning would be worthwhile exploring.

Microlearning, when thoughtfully designed for transfer support is shown to be embraced by nurses as a way of verifying their understanding and maintaining their memory of training on a complex skillset. It can be readily designed to promote spaced practice and reflection to complement other formal training interventions in the environment. With its ability to be integrated into the workflow and its association with strong intent to transfer, further application and evaluation of this promising technique is warranted.

References

Adobe Inc. Adobe Audition [Audio editing and mixing software]. California: Adobe.

Ajzen, I. (1991). The theory of planned behavior. *Organizational behavior and human decision processes*, *50*(2), 179-211. https://doi.org/10.1016/0749-5978(91)90020-T

Al-Eisa, A. S., Furayyan, M. A., & Alhemoud, A. M. (2009). An empirical examination of the effects of self-efficacy, supervisor support and motivation to learn on transfer intention. *Management Decision, 47*(8), 1221-1244. http://dx.doi.org/10.1108/00251740910984514

Alvarez, K., Salas, E., & Garofano, C. M. (2004). An integrated model of training evaluation and effectiveness. *Human Resource Development Review, 3*(4), 385–416. http://dx.doi.org/10.1016/j.hrmr.2007.07.004

Apple Inc. (2019). Final Cut Pro (Version X) [Video editing software]. California: Apple.

Arthur Jr, W., Bennett Jr, W., Edens, P. S., & Bell, S. T. (2003). Effectiveness of training in organizations: A meta-analysis of design and evaluation features. *Journal of Applied Psychology, 88*(2), 234. http://dx.doi.org/10.1037/0021-9010.88.2.234

Articulate Global (2019). Storyline 3 [E-learning authoring software]. New York: Articulate.

Artino, A.R., Jr. (2008). Cognitive load theory and the role of learner experience: An abbreviated review for educational practitioners. *Association for the Advancement of Computing in Education Journal, 16*(4), 425-439. Chesapeake, VA: Association for the Advancement of Computing in Education (AACE). Retrieved September 5, 2019 from https://www.learntechlib.org/primary/p/25229/.

Baldwin, T. T., & Ford, J. K. (1988). Transfer of training: A review and directions for future research. *Personnel psychology*, *41*(1), 63-105. https://doi.org/10.1111/j.1744-6570.1988.tb00632.x

Blume, B. D., Ford, J. K., Surface, E. A., & Olenick, J. (2019). A dynamic model of training transfer. *Human Resource Management Review, 29*(2), 270-283. https://doi.org/10.1016/j.hrmr.2017.11.004

Brown, P. C., Roediger III, H. L., & McDaniel, M. A. (2014). Chapter 2: To learn, retrieve. In *Make it stick*: *The science of successful learning (*pp. 23-45). Cambridge, MA: Harvard University Press.

Burke, L. A., & Hutchins, H. M. (2007). Training transfer: An integrative literature review. *Human Resource Development Review, 6*(3), 263-296. https://doi.org/10.1177/1534484307303035

Carliner, S. (2002). Choices and challenges: Considerations for designing electronic performance support systems. *Technical Communication*, *49*(4), 411-419. Retrieved from https://search.proquest.com/

Creswell, J. W. (2008). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (3rd Ed.). Upper Saddle River, NJ: Pearson Prentice Hall.

Chisholm, L. (2005). Micro-learning in the Lifelong Learning Context. In T. Hug, M. Lindner, P. A. Bruck (Eds.) *Microlearning: Emerging concepts, practices and technologies after e-Learning* (pp. 5-6). Proceedings of Microlearning 2005. Retrieved August 1, 2019 from https://www.researchgate.net/publication/246822097

Donovan, J. J., & Radosevich, D. J. (1999). A meta-analytic review of the distribution of practice effect: Now you see it, now you don't. *Journal of Applied Psychology, 84*(5), 795–805. https://doi.org/10.1037/0021-9010.84.5.795

Duvernet, A., & Whelan, T. (2017, April). Learning about learning: Trends in workplace training. *TIP: The Industrial-Organizational Psychologist, 54*(4), 41-47. Retrieved from http://www.siop.org/tip/april17/ll.aspx

Eldridge, B. (2017). Developing a microlearning strategy with or without an LMS. *ELearning & Software for Education, 1*, 48-51. https://doi.org/10.12753/2066-026X-17-007

Eibl, T. (2007). What size is micro? – Using a didactical approach based on learning objectives to define granularity. In T. Hug (Ed.) *Didactics of Microlearning* (pp.125-138). Münster, Germany: Waxmann.

Emerson, L. C., & Berge, Z. L. (2018). Microlearning: Knowledge management applications and competency-based training in the workplace. *Knowledge Management & E-Learning: An International Journal (KM&EL), 10*(2), 125-132. https://doi.org/10.34105/j.kmel.2018.10.008

Eraut, M. (2000). Non-formal learning and tacit knowledge in professional work. *British journal of educational psychology*, *70*(1), 113-136. https://doi.org/10.1348/000709900158001

Ford, J. K., Baldwin, T. T., & Prasad, J. (2018). Transfer of training: The known and the unknown. *Annual Review of Organizational Psychology and Organizational Behavior*, *5*, 201-225. https://doi.org/10.1146/annurev-orgpsych-032117-104443

Gaudine, A. P., & Saks, A. M. (2004). A longitudinal quasi-experiment on the effects of post training transfer interventions. *Human Resource Development Quarterly*, *15*(1), 57-76. https://doi.org/10.1002/hrdq.1087

Gegenfurtner, A. (2013). Dimensions of motivation to transfer: A longitudinal analysis of their influence on retention, transfer, and attitude change. *Vocations and Learning*, *6*(2), 187-205. https://doi.org/10.1007/s12186-012-9084-y

Gery, G. (1995). Attributes and behaviors of performance-centered systems. *Performance improvement quarterly*, *8*(1), 47-93. https://doi.org/10.1111/j.1937-8327.1995.tb00661.x

Green, J., & Thorogood, N. (2014). *Qualitative methods for health research* (3rd ed.). London, United Kingdom: Sage Publications Ltd.

Grossman, R., & Salas, E. (2011). The transfer of training: what really matters. *International Journal of Training and Development*, *15*(2), 103-120. https://doi.org/10.1111/j.1468-2419.2011.00373.x

Hug, T. & Friesen, N. (2007). Outline of a microlearning agenda. In T. Hug (Ed.) *Didactics of Microlearning* (pp.15-31). Münster, Germany: Waxmann.

Hutchins, H. M., Nimon, K., Bates, R., & Holton, E. (2013). Can the LTSI predict transfer performance? Testing intent to transfer as a proximal transfer of training outcome. *International Journal of Selection and Assessment, 21*(3), 251-263. https://doi.org/10.1111/ijsa.12035

Kapp, K. & Defelice, R. (2018, July). Elephant sized impact. *Training Development*, 27-30. Retrieved from https://www.td.org/magazines/td-magazine/elephant-sized-impact

Kerres, M. (2007). Microlearning as a challenge for instructional design. In T. Hug (Ed.) *Didactics of Microlearning* (pp.98-109). Münster, Germany: Waxmann.

Kim, J. W., Ritter, F. E., & Koubek, R. J. (2013). An integrated theory for improved skill acquisition and retention in the three stages of learning. *Theoretical Issues in Ergonomics Science, 14*(1), 22-37. https://doi.org/10.1080/1464536X.2011.573008

LimeSurvey GmbH. LimeSurvey [Survey software]. Germany: LimeSurvey.

McGill University Health Centre (2007). Pressure Ulcer Staging [Definitions]. Retrieved from McGill University Health Centre Intranet https://www.mymuhc.muhc.mcgill.ca

McGill University Health Centre Wound and Ostomy Team (2010). Algorithm for the prevention and management of pressure ulcers. Retrieved from McGill University Health Centre Intranet https://www.mymuhc.muhc.mcgill.ca

Merriam, S. B., & Bierema, L. L. (2013). *Adult learning: Linking theory and practice* [Adobe Digital Editions version]. Retrieved from https://www.wiley.com/en-ca/Adult+Learning%3A+Linking+Theory+and+Practice-p-9781118130575

Miller, G. A. (1956). The magical number seven, plus or minus two: Some limits on our capacity for processing information. Psychological Review, 63, 81-97. https://doi.org/10.1037/h0043158

Norton, L., Parslow, N., Hohnston, D., Ho, C., Afalavi, A., Mark, M., O'Sullivan Drombolis, D., Moffat, S. (2018). Best practice recommendations for the prevention and management of pressure injuries. In *Foundations of Best Practice for Skin and Wound Management. A supplement of Wound Care Canada.* Retrieved December 5, 2018 from https://www.woundscanada.ca/health-care-professional/education-health-care-professional/advanced-education/12-healthcare-professional/110-supplements.

Ordre des infirmières et infirmiers du Québec (2011, Septembre). La formation continue pour la profession infirmière au Québec : Norme professionnelle. Ordre des infirmières et infirmiers du Québec. Retrieved from www.oiiq.org

Orsted, H. L., Keast, D. H., Forest-Lalande, L., Kuhnke, J. L., O'Sullivan-Drombolis, D., Jin, S., Haley, J., & Evans, R. (2018). Best practice recommendations for the prevention and management of wounds. In *Foundations of Best Practice for Skin and Wound Management. A supplement of Wound Care Canada.* Retrieved December 5, 2018 from https://www.woundscanada.ca/health-care-professional/education-health-care-professional/advanced-education/12-healthcare-professional/110-supplements.

Pashler, H., Rohrer, D., Cepeda, N. J., & Carpenter, S. K. (2007). Enhancing learning and retarding forgetting: Choices and consequences. *Psychonomic bulletin & review*, *14*(2), https://doi.org/10.3758/BF03194050

Quinn, C. N. (2018). *Millennials, goldfish & other training misconceptions: Debunking learning myths and superstitions.* Retrieved from https://play.google.com/books/

Registered Nurses Association of Ontario (2016a). Best Practice Guidelines: Assessment and Management of Pressure Injuries for the Interprofessional Team (3rd Ed.). Retrieved from https://rnao.ca/bpg/guidelines/pressure-injuries

Registered Nurses Association of Ontario (2016b, October 14). In the Know with RNAO Webinar [Video file]. Retrieved from https://youtu.be/EuJ6ex7KZmQ

Russ-Eft, D. (2002). A typology of training design and work environment factors affecting workplace learning and transfer. *Human Resource Development Review*, *1*(1), 45-65. https://doi.org/10.1177/1534484302011003

Rustici Software. SCORM Cloud [Online learning management platform]. Tennessee: Rustici Software. Retrieved from https://cloud.scorm.com/

Saks, A. M. (2002). So what is a good transfer of training estimate? A reply to Fitzpatrick. *The Industrial-Organizational Psychologist*, *39*(3), 29-30. Retrieved from https://www.researchgate.net/profile/Alan_Saks/publication/239769006_So_What_is_a_Good_Transfer_of_Training_Estimate_A_Reply_to_Fitzpatrick/links/556f083808aeccd7774106f7.pdf

Salas, A. (2017, March 15). Microlearning: What it is not and what it should be. Learning Solutions Magazine. Retrieved from https://www.learningsolutionsmag.com/articles/2255/microlearning-what-it-is-not-and-what-it-should-be

Salas, E., & Stagl, K. C. (2009). Design training systematically and follow the science of training. In E. A. Locke (Ed.) *Handbook of principles of organizational behavior: Indispensable knowledge for evidence-based management* (2nd Ed.) (pp. 59-84). West Chichester, United Kingdom: John Wiley & Sons.

Salas, E., Tannenbaum, S. I., Kraiger, K., & Smith-Jentsch, K. (2012). The science of training and development in organizations: What matters in practice. *Psychological Science in the Public Interest, 13*(2), 74-101. https://doi.org/10.1177/1529100612436661

Schachtner, C. (2005). Precise and succinct yet interlinked requirements for e-learning in the workplace (on microlearning). In T. Hug, M. Lindner & P.A. Bruck (Eds.) *Microlearning: Emerging concepts, practices and technologies after e-learning.*

Proceedings of Microlearning 2005. Learning & Working in New Media (pp. 71-78). Innsbruck, Austria: Innsbruck University Press. http://www.jstor.org/stable/23359412

Shank, P. (2018, February 19). Microlearning, macrolearning. What does research tell us? *eLearningIndustry.com*. Retrieved from https://elearningindustry.com/microlearning-macrolearning-research-tell-us

Son, L. K., & Simon, D. A. (2012). Distributed learning: Data, metacognition, and educational implications. *Educational Psychology Review, 24*(3), 379–399. http://doi.org/10.1007/s10648-012-9206-y

St-Cyr, D., Abner, D., & Lemieux, L. (2010). Wound assessment record and topical wound treatment record [Nursing Protocol – MUHC]. Retrieved from McGill University Health Centre Intranet https://www.mymuhc.muhc.mcgill.ca

Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive science*, *12*(2), 257-285. https://onlinelibrary.wiley.com/doi/pdf/10.1207/s15516709cog1202_4

Sweller, J., van Merriënboer, J. J. G., & Paas, F. G. W. C. (1998). Cognitive Architecture and Instructional Design. *Educational Psychology Review, 10*(3), 251-296. http://www.jstor.org/stable/23359412

Thalheimer, W. (2015, October 28). A timeless need for subscription learning [Blog post]. Retrieved September 29, 2018 from https://www.worklearning.com/2015/10/28/a-timeless-need-for-subscription-learning/

Thalheimer, W. (2016). *Performance-focused Smile Sheets: A Radical Rethinking of a Dangerous Art Form* [Adobe Digital Editions version]. Retrieved from https://www.ebscohost.com/ebooks

Thalheimer, W. (2006, February). *Spacing learning events over time: What the research says.* Retrieved September 29, 2018, from http://www.work-learning.com/catalog/

Wang, X., Day, E. A., Kowolik, V., Schuelke, M. J., & Hughes, M. G. (2013). Factors influencing knowledge and skill decay after training. In W. Arthur Jr., E.A. Day, W. Bennett Jr. & A. M. Portrey (Eds.), *Individual and team skill decay: The science and implications for practice* (pp. 68-116). New York, NY: Routledge.

Yang, C. W., Yen, Z. S., McGowan, J. E., Chen, H. C., Chiang, W. C., Mancini, M. E., Soar, J., Lai, M. S. & Ma, M. H. M. (2012). A systematic review of retention of adult advanced life support knowledge and skills in healthcare providers. *Resuscitation*, *83*(9), 1055-1060. https://doi.org/10.1016/j.resuscitation.2012.02.027

Yin, R. K. (2009). *Case study research: Design and methods* (4th Ed.). Los Angeles, CA: Sage.

Appendix A

Initial Questionnaire (Paper Format)

(This section will be removed once study code is assigned)

Name : _____

Initial Questionnaire

Study Code :

1) What unit do you work on? _____

2) My Work Unit is which of the following: (Circle one)
a) Intensive Care Unit b) Ward c) Emergency d) Clinic e) Other: _____

3) My job title is: (Circle one)
a) Nurse Clinician b) Assistant Head Nurse c) Other: _____

4) Nursing Experience: ____ years

5) Education: (Circle all that apply)
a) DEC b) Bachelor of Nursing c) Master of Nursing d) Nurse Practitioner

6) Are you currently caring for a patient requiring wound-care? (Circle one) Yes / No

7) Please number the resources in the order that you would use them, if you had a question about wound-care after the workshop (i.e. 1st, 2nd, 3rd, 4th, 5thor 6th):

Resources	I am most likely to use (Order as: 1st, 2nd, 3rd, 4th, 5th or 6th)
Ask a colleague	
Ask my Assistant Head Nurse	
Look on the Intranet for policies and procedures	
Do an internet search	
Consult a Wound Care Specialist	
Other: _____	

8) "After the course, when you begin to apply your new wound care knowledge on your work unit, which of the following supports do you expect to have? *

Select as many items as are likely to be true.
❒ I will have ENOUGH TIME at work to use what I have learned for patient care.
❒ I will be ENCOURAGED BY MY NURSING SUPERVISOR to use what I have learned.
❒ I will have an experienced colleague TO MENTOR ME in using what I have learned.
❒ I will have contact with FELLOW LEARNERS for guidance and support.
❒ I will be ENCOURAGED BY MY COWORKERS to use what I have learned.
❒ I will have JOB AIDS to guide me to use what I have learned.
❒ I will NOT get much direct support but will rely on my own initiative."

* Adapted from Thalheimer, W. (2016). Chapter 6 Candidate questions for a performance-focused smile sheet. *Performance-focused Smile Sheets: A Radical Rethinking of a Dangerous Art Form.* Somerville, MA: Work-Learning Press

Final Question on next page.

9) Please indicate your agreement with the following statements about the wound care training that you have completed. Use the following scale of 1 to 5 where:

1 = strongly do not agree, 2 = do not agree, 3 = partly agree, 4 = agree, 5 = strongly agree

- "I will try to use the training content in my workplace." [§]

1	2	3	4	5
(strongly do not agree)		(partly agree)		(strongly agree)

- "I feel able to use the training content at work." [§]

1	2	3	4	5
(strongly do not agree)		(partly agree)		(strongly agree)

- "The training has prepared me well for applying the training content." [§]

1	2	3	4	5
(strongly do not agree)		(partly agree)		(strongly agree)

[§] Gegenfurtner, A. (2013). Dimensions of motivation to transfer: A longitudinal analysis of their influence on retention, transfer, and attitude change. *Vocations and Learning*, *6*(2), 187-205. https://doi.org/10.1007/s12186-012-9084-y , Cronbach's α=0.79

Appendix B

Microlearning Survey

These questions will be provided at the end of each microlearning module

Questions:

1) Have you used any other resource on wound care (a peer, expert advice, another source of information) since the last training?

Yes / No →

If Yes	If No
Please describe the resource you used: _____	Proceed to next question.

2) Have you discussed or shared the **microlearning** content with any colleagues at work?

Yes / No

3) Have you had a chance to use what you learned at the wound care **workshop** on the job yet?

Yes / No →

If Yes
a) **When?** ❒ Today ❒ In the past 3 days ❒ In the past week ❒ In the past two weeks

If No
Proceed to next question

4) Please indicate your level of agreement with the following statements about the wound care training that you have completed to date (workshop and microlearning).
Use the following scale of 1 to 5 where:
1 = strongly do not agree, 2 = do not agree, 3 = partly agree, 4 = agree, 5 = strongly agree

- "I will try to use the training content in my workplace." [§]

1 (strongly do not agree) **2** **3** (partly agree) **4** **5** (strongly agree)

- "I feel able to use the training content at work." [§]

1 (strongly do not agree) **2** **3** (partly agree) **4** **5** (strongly agree)

- "The training has prepared me well for applying the training content." [§]

1 (strongly do not agree) **2** **3** (partly agree) **4** **5** (strongly agree)

End of Survey Message: Thank You for answering these questions! It will help improve future training opportunities offered to you.

[§] Gegenfurtner, A. (2013). Dimensions of motivation to transfer: A longitudinal analysis of their influence on retention, transfer, and attitude change. *Vocations and Learning*, *6*(2), 187-205. https://doi.org/10.1007/s12186-012-9084-y , Cronbach's α=0.79

Appendix C

Final Questionnaire

This questionnaire will be electronic. It will be developed using LimeSurvey that is hosted on a Concordia server and is privacy protected.

It would be really helpful to hear from you about why you did or did not use the microlearning. This will help us know how to better support you in future training. It should not take more than 15 minutes to complete this questionnaire. Many thanks!

1) Since the workshop, how many times have you been able to use your **new wound care knowledge** for patient care?

❒ 0 times ❒ Only 1 time ❒ 2-4 times ❒ 5-7 times ❒ More than 7 times

2) What would you say motivates you to use your **new wound care knowledge**?

_____

3) Since the wound care workshop, have you had a chance to discuss what you learned with colleagues?

If Yes	If No
What prompted the discussion? _____	Proceeds to next question.

4) Were you able to use the **microlearning resources** since the workshop?
Yes / No →

If Yes

a) Did you ever use the microlearning **close to a time when you provided wound care**?

If Yes	If No
Tell us why: _____	When did you use it? _____

b) **Where** did you do the microlearning? Choose all that apply:
❒ nursing station computer ❒ office computer ❒ home computer ❒ other: _____

c) Please indicate your agreement with the following statements on a scale of 1 to 5 where:
1 = strongly do not agree, 2 = do not agree, 3 = partly agree, 4 = agree, 5 = strongly agree

- Using the microlearning helped me remember some information from the workshop

1	2	3	4	5
(strongly do not agree)		(partly agree)		(strongly agree)

- It was difficult to find time to complete the microlearning

1	2	3	4	5
(strongly do not agree)		(partly agree)		(strongly agree)

d) What did you find most helpful about the microlearning? _____

e) What would you change about the microlearning? _____

If No

a) It would be helpful to know what made it challenging to use so we know for future microlearning follow-ups. Please tell us why you were not able to use it: _____

b) What would help make microlearning more usable for you in the future?

_____

c) Any other suggestions? _____

5) Please place the listed resources in the order that you would use them if you had a question about wound-care after the workshop. Place the resource you are most likely to use at the top of the list, followed by the second most likely resource, until they have all been ranked.

Resources	Your ranking
Ask a colleague	1.
Ask my Assistant Head Nurse	2.
Look on the Intranet for policies and procedures	3.
Do an internet search	4.
Refer to microlearning resources	5.
Consult a Wound Care Specialist	6.

6) Please indicate any **other** resource that you would use if you had a question about wound care:

_____

How likely are you to use this resource compared to the other resources? Choose one answer:

❒ Highly likely to use this resource.
❒ Moderately likely to use this resource.
❒ Unlikely to use this resource.

7) "After the course, when you began to apply your new wound care knowledge on your work unit, which of the following supports did you have? *

Check all that apply:

❒ I had ENOUGH TIME at work to use what I had learned for patient care.
❒ I was ENCOURAGED BY MY NURSING SUPERVISOR to use what I had learned.
❒ I had an experienced colleague TO MENTOR ME in using what I had learned.
❒ I had contact with FELLOW LEARNERS for guidance and support.
❒ I was ENCOURAGED BY MY COWORKERS to use what I had learned.
❒ I had JOB AIDS to guide me to use what I had learned.
❒ I did NOT get much direct support but relied on my own initiative."

8) Thinking about future wound care opportunities, please indicate your agreement with the following statements about the wound care training that you have completed (workshop and any of microlearning). Use the following scale of 1 to 5 where:

1 = strongly do not agree, 2 = do not agree, 3 = partly agree, 4 = agree, 5 = strongly agree

- "I will try to use the training content in my workplace." §

1 2 3 4 5
(strongly do not agree) (partly agree) (strongly agree)

- "I feel able to use the training content at work." §

1 2 3 4 5
(strongly do not agree) (partly agree) (strongly agree)

- "The training has prepared me well for applying the training content." §

1 2 3 4 5
(strongly do not agree) (partly agree) (strongly agree)

End of Survey Message: Thank you for your feedback!

* Adapted from Thalheimer, W. (2016). Chapter 6 Candidate questions for a performance-focused smile sheet. *Performance-focused Smile Sheets : A Radical Rethinking of a Dangerous Art Form.* Somerville, MA: Work-Learning Press

§ Gegenfurtner, A. (2013). Dimensions of motivation to transfer: A longitudinal analysis of their influence on retention, transfer, and attitude change. *Vocations and Learning*, *6*(2), 187-205. https://doi.org/10.1007/s12186-012-9084-y , Cronbach's α=0.79

Appendix D

Interview Guide

I would like to ask you some questions about the time since the wound care workshop to better understand what your experience was like returning to work with this new information and how the microlearning fit into this experience. *Just a reminder:* If you will be using examples of care provided to patients, please do not disclose any identifying patient information.

1) **Since you returned from the wound-care workshop tell me about the type of support you have had on your unit to put what you had learned into practice?**

2) *Depends on if had opportunity to put skills into practice (known from previous data):*

If Yes	If No
a) How ready did you feel, the first time you were able to apply your wound care knowledge after the workshop? Did you review anything?	**a) If you had to provide wound care today to a patient, how prepared would you feel?** If you had a question, what would you do to prepare?
b) Thinking about the care you provided, what, if anything, did you find helpful from the microlearning? Did you feel comfortable to refer to the microlearning during work?	**b) How did the microlearning fit with the workshop content?** Was there something new that you learned or something that was clearer with the microlearning?

3) Can you describe for me the setting where you used the microlearning?
- Were you at the nursing station, your office, at home…?
- Why did you choose to use it in this location? / What prevented you from using it in other contexts?
- How close was the timing between using the microlearning and providing wound care?

4) What did you think about how the microlearning was provided?

5) What motivated you to do the microlearning?
If you hadn't been part of this study would you still have referred to the microlearning if it was available?

6) What would you suggest in order to make the microlearning easier to use?

7) Can you tell me about whether the microlearning or something that you learned in the wound care workshop ever come up in conversation with colleagues at work?

8) What surprised you about this experience with microlearning?

Thank You so much for your time and all of the helpful information you've provided. If, when I am analyzing the data from this interview, I need to clarify something that you have said today, do I have your permission to contact at the e-mail address you have provided for the study?

Appendix E

Pilot Survey for Microlearning Questionnaires

Thank you for agreeing to be a pilot participant!

Please:

- Open the questionnaire file: "Microlearning Study Questionnaires.pdf"
- Kindly take note of the time as you start the questionnaire, so you know how long it took to complete.
- When you finish the questionnaire, please send it to Naomi Burton-MacLeod, Researcher at: [Researcher's e-mail]

1. How much time did you spend on each questionnaire?

Initial Questionnaire: _____ minutes
Microlearning Survey: _____ minutes
Final Questionnaire: _____ minutes

2. Overall, how clear were the **instructions** for completing the questionnaires? (Highlight your chosen response.)

1	2	3	4	5
Completely confusing		Neither clear nor confusing		Completely clear

If you encountered an unclear response, please tell us more.
(Add rows if you have additional instructions on which to comment.)

Copy the unclear instruction here.	**To the best of your ability, describe the issue with the unclear instruction.**	**If you can think of one, suggest how to reword the instruction so it is clearer. (If you have such a suggestion, that's great. If not, then leave this blank.)**

Continued on next page.

Pilot Survey for Microlearning Questionnaires (continued)

3. Overall, how clear were the **questions**? (Highlight your chosen response.)

1	2	3	4	5
Completely confusing		Neither clear nor confusing		Completely clear

If you encountered an unclear question, please tell us more. (Add rows if you have additional questions on which to comment.)

Copy the unclear question here.	**To the best of your ability, describe the issue with the unclear question.**	**If you can think of one, suggest how to reword the instruction so it is clearer. (If you have such a suggestion, that's great. If not, then leave this blank.)**

4. Do you think any important questions were missing? __ Yes __ No

If you feel one or more important questions were missing, please tells us what they are:

Thank you for participating in this pilot!

Please send the completed questionnaire Naomi Burton-MacLeod, Researcher at:

[Researcher's e-mail]

Appendix F

Frame Interview Summary

In preparation for data collection and analysis, a frame interview was conducted by the Research Supervisor with the Researcher to facilitate reflection on pre-existing perspectives and expectations. The interview occurred on January 15, 2019 and lasted 30 minutes. The core reflections for each question posed are presented here.

1. What opinions do you have about the current state of nursing continuing professional development?

Site-specific experience. The Researcher has worked in the context of the research site for 9 years as a nurse. From the Researcher's experience, continuing professional development opportunities have been constrained by limited resources; a small number of courses are offered internally within the hospital per year and there is an application process for nurses to be approved to attend. This is a competitive process as nurses are liberated of their work duties in order to attend training during work hours and there is no cost to attend. The application process is in place to ensure regulation of the number of nurses who attend and adequate staffing to cover clinical duties of nurses who are attending training. Finally, there are budgetary constraints as there is a fixed amount per year allocated to covering all continuing professional development training within the hospital. This budget must be allocated evenly to cover the logistical fees to provide training and the staffing costs to attend. Furthermore, as a unionized profession the equal distribution of training opportunities is monitored leading to a rotational approval of individual requests for training meaning that only a set number of funded opportunities are available within each department and will be allocated to different nurses each time unless mandatory for all staff.

The logistical and financial investment for on-site training during work hours influences the format of training delivered. Nurses are usually covered for the shift and so workshops are full-day, information heavy events that can be delivered to multiple nurses at one time, for a single block of time to minimize frequent interruption of nursing duties to attend/participate in training.

Professional requirements. To maintain a license to practice nursing in the province of Québec, a minimum of 20 continuing education hours must be documented; 7 hours of which must be spent on accredited activities. Accreditation is granted by a provincial regulating body. These recording and monitoring of these required continuing professional development hours has

been in effect since January 2012 but with an initial phase-in period accounting for the increased demand for accredited training but the slowly growing number of actually accredited activities. In the Researcher's experience, demand for accredited training opportunities within the hospital have been particularly sought after as they are free to attend and conducted during workhours. In contrast, externally provided accredited hours are available (predominantly through the provincial licensing body) but are done on the nurse's own time and cost. This external training typically is delivered as online learning modules and in-person workshops held at different conventions.

2. How does your prior work experience at the research site inform your expectations of non-formal learning associated with microlearning?

The Researcher has frequently witnessed non-formal learning exchanges among nurses. With opportunities to attend formal learning allocated and therefore competitive, there is an expectation that those who attend will share what they have learned with their colleagues. This culture promotes the sharing of training. On the other hand, when there is a required change in practice, this can be met with resistance by colleagues, especially if implementation is not initiated by management with follow-up measures.

The evolution of a nurse's expertise is also inherently linked to experiences in the workplace working with patients and families. These informal learning opportunities provide the framework to which the nurse can attach meaningful knowledge.

3. How does your prior work experience at the research site inform your expectations of environmental factors that can influence microlearning use and training transfer?

The researcher has had experience with e-learning at the research -site. Mandatory training was provided ranging from 15-45 minutes, and it was the responsibility of the nurse to find the time to complete it before a set deadline. Time management was required to work the mandatory training into a shift or to obtain coverage to take time to complete it. This resulted in a high likelihood of interruption because of priority of clinical responsibilities. Additionally, up until two years ago, access to the e-learning zone was exclusively on hospital computers, restricting completion to work hours. Recently however, the e-learning zone has become accessible off-site so could be used on a personal device.

4. What assumptions do you have about those who will participate in your study?

The workshop attendees which will serve as the recruitment pool for study participation will be motivated in part to attend the workshop because it provides 6 accredited hours. Those who choose to participate in the study will likely have even higher levels of personal motivation than the general recruitment pool as they will be individuals looking for training opportunities above and beyond accredited training. Other motivators for participation may be the frequency with which a nurse provides wound care (higher frequency being more interested to learn more for application). Independent of frequency, nurses who are caring for a patient requiring wound care at the time of recruitment may also be motivated because of the concurrent care and anticipated relevance of the microlearning. Considering these factors, those who choose to participate in the study are more likely to apply the skillset because of interest and motivation levels as well as current care responsibilities than the broader recruitment pool.

5. What do you expect will happen with the microlearning initiative? Why?

It is expected that the way in which microlearning is delivered (library access or sequentially timed) will affect the use of the microlearning. It is anticipated that participants with library access will have the best of intentions at the start of the study but without sequential reminders, may be less likely to complete all three available microlearning. Those who receive the microlearning sequentially will be more likely to complete all three as the e-mails will act as reminders and will be spaced out over time.

6. How does your prior education and work experience predispose you to a certain type of analysis?

From prior studies in basic and applied sciences, the researcher has a predisposition to quantitative methodology and may be prone to enumerating trends and themes. The research will aim to remember that qualitative analysis requires contextualization and the exploration of themes in greater depth. Additionally, the Researcher will need to bear in mind that there is not a single ‘right’ answer to the research questions but rather the responses will be nuances and may in fact lead to more questions. Patterns and frequency of themes will still be important during analysis however, bearing in mind the need to triangulate data.

7. What beliefs do you hold about nursing practice that could influence your analysis of results?

As a nurse, the Researcher believes in the need of evolution of practice knowledge and therefore the need to update knowledge over time. Professional education does not stop upon graduation from the professional degree or acquiring the professional license; in many senses the true applied learning is only just beginning. Much of this development is informal in nature through colleagues and reflection on experiences. The formal requirement and acknowledgement of continuing professional development for maintenance of competency in nursing lags the trend in medicine. Structured and formal requirements for continuing professional development in Quebec being as recent as 2012. This requirement is viewed by the Researcher as necessary if cumbersome process, namely the burden of keeping track of hours and having to keep records. However, the Researcher hopes that it will stimulate the development of further opportunities for continuing education, once the accreditation process becomes more streamlined. Currently the accreditation process is a rate-limiting step in the number of training opportunities offered by the hospital Continuing Professional Development department.

8. What beliefs about instructional design do you hold that could influence your analysis of results?

The Researcher believes that effective instructional design to support adult learning must provide relevant, complementary information to their work, the information should be provided over time and should be applicable to their past and ongoing experiences. The information should be presented in such a way that it is actionable.

9. Anything worried about? **If data are different than expect (i.e. equally ineffective)?**

Given the belief of the Researcher that the microlearning should be relatively easy to use, the Researcher would be disappointed if the microlearning, developed by the Researcher, was not used or viewed as useful by the participants. If this occurs however, the Researcher will attempt to focus on why such a situation arose since theoretically the microlearning is expected to be useful.

Should the methods of delivering microlearning turn out to be the same, it would be of interest to the Researcher to hypothesize why and to seek to explain these results. The Researcher will engage in reflection throughout analysis to ensure that they are suspending their personal experience and not extending the interpretation of the data.

Appendix G

Figures of Microlearning Features

Figure 1. Sample of microlearning topic-identifying title and explicit timing information.

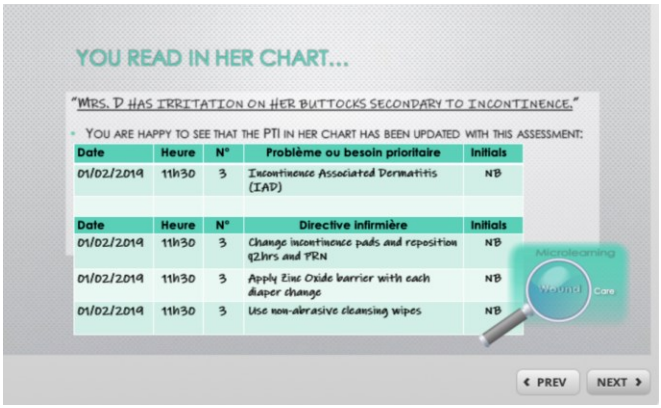

Figure 2. Case scenario information provided in standard care plan worksheet format (PTI).

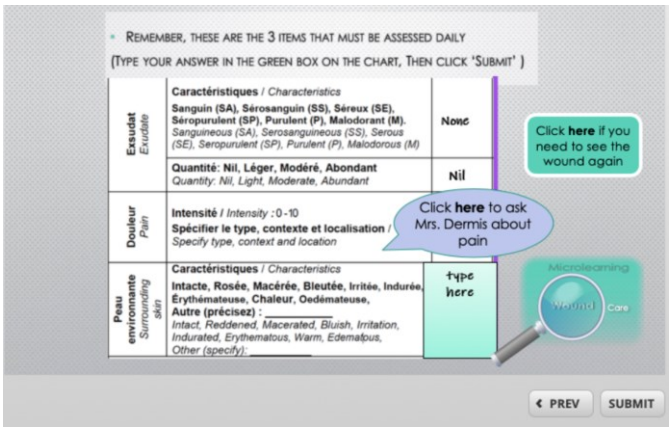

Figure 3. Interactive wound assessment record and direct link to hospital algorithm.

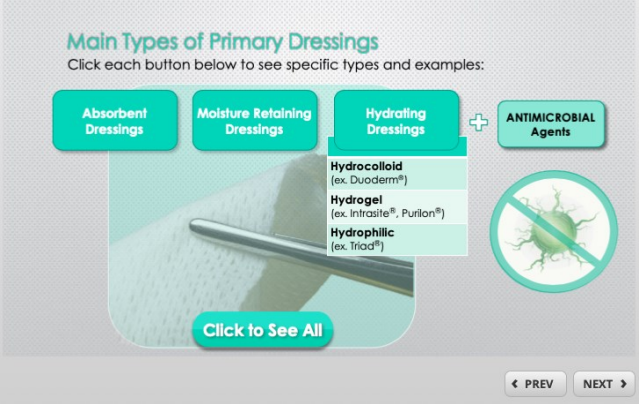

Figure 4. Overview of primary dressing types and examples, doubling as a job-aid.

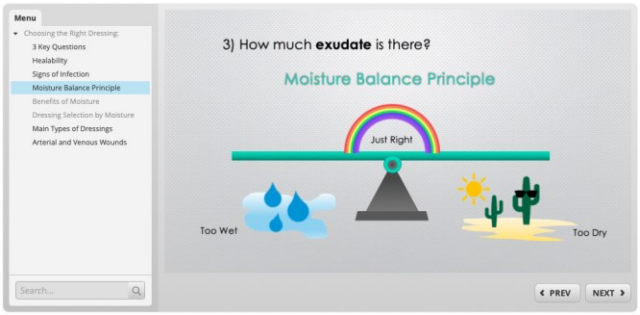

Figure 5. Moisture balance principle analogy and side-bar navigation.

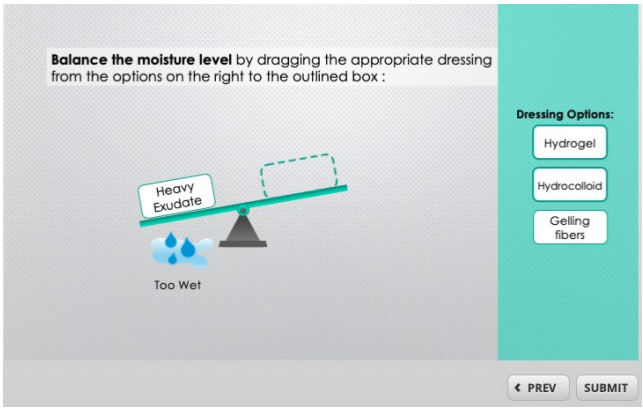

Figure 6. Drag-and-drop question on dressing selection to balance wound moisture.

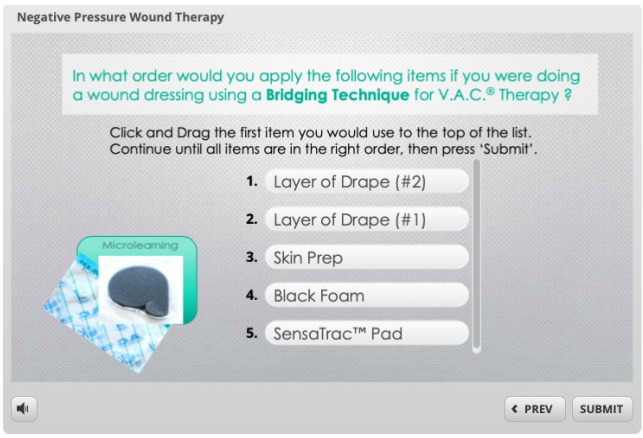

Figure 7. Interactive question on correct layering of material for bridging technique.

Appendix H

Information and Consent Form for Study Participation

[Hospital Logo Redacted]

INFORMATION AND CONSENT FORM

Study Title: Case Study of a Microlearning Follow-Up Initiative to Support Training Transfer
[Hospital] Protocol number: 2019-5215

Researcher: Naomi Burton-MacLeod, Master's student in Educational Technology
Researcher's Contact Information:
Address: Department of Education, FG-5.150, 1455 de Maisonneuve Street W., Concordia University, Montreal, Quebec, H3G 1M8
Phone: [redacted]
E-mail: naomi.burton-macleod@mail.concordia.ca

[Hospital] Principal Investigator: [redacted]
[Hospital] Principal Investigator's Contact Information:
[redacted]

Faculty Supervisor: Dr. Saul Carliner
Faculty Supervisor's Contact Information:
Address: Department of Education, FG-5.150, 1455 de Maisonneuve Street W., Concordia University, Montreal, Quebec, H3G 1M8
Phone: (514) 848-2424, ext. 2038
E-mail: saul.carliner@concordia.ca

Source of funding for the study:
Social Sciences and Humanities Research Council (SSHRC) of Canada

INTRODUCTION

You are being invited to participate in the research study mentioned above. This form provides information about what participating would mean. Please read it carefully before deciding if you

want to participate or not. If there is anything you do not understand, or if you want more information, please ask the researcher.

A. PURPOSE OF THE RESEARCH STUDY

The purpose of the research is to describe the experience of using short e-learning, called *microlearning*, as follow-up to an information-heavy workshop when the microlearning is provided in two different ways and to understand if it is viewed by nurses as useful for their work.

B. RESEARCH PROCEDURES

If you participate, you will be asked to:

- Fill out a short questionnaire to tell us some information about your nursing context and how ready you feel to use the knowledge from today's workshop (10 minutes).
- Complete three microlearning modules over the next month. These modules will provide additional interactive content on wound care related to today's workshop and include a couple of questions for the study about wound care opportunities, supports used and peer interest. Each module will take no more than 10 minutes to complete. The modules can be accessed from any computer (home or work) by using the links that will be provided to you by e-mail.
- Fill out a questionnaire after 4 weeks to tell us about your experience with the microlearning, your opportunities to provide wound care since this workshop and how ready you felt to use the information from the workshop on the job (15 - 20 minutes).
- You *may* be selected to participate in an interview. If you are selected, you will be contacted by e-mail and you can decide at that time if you wish to participate in the interview or not (45 minutes).

In total, participating in this study will take between 1-2 hours depending on if you are interviewed or not.

Participants will be assigned by the researcher to receive the microlearning in one of two ways: 1) sent one at a time for use at set intervals over four weeks or 2) sent all at once for use whenever wanted over four weeks.

C. RISKS AND BENEFITS

You may or may not benefit from this study. Potential benefits include having access to additional educational material related to the wound care training you completed during the workshop. Results from this study will also help the Department of Nursing, Continuing

Professional Skill Development use microlearning in a way that best supports your nursing practice.

There is minimal risk to participating in this study. It may occur that you will be asked by colleagues about the microlearning while using it in the workplace. A possible risk associated with this study is a breach of confidentiality or use of your personal information by a third party. To limit this risk, we will take the steps to protect your confidentiality described in the Confidentiality section, below. Information that you provide to the researcher as part of the microlearning or study will not be shared with your colleagues or manager and it will not have any impact on your employment status as a nurse. This consent form will NOT be placed in your employment record. Information you provide will have identifying information removed and will be given a code instead. The coded information will be accessed only by people directly involved with the study.

Some people may feel uncomfortable speaking about their work experiences. You do not have to answer a question if you do not feel comfortable doing so. Again, all information you provide will be kept confidential.

There is no cost to you to participate in this study and you will not receive financial compensation for participating in this research study. We do not foresee any other risks associated with this study.

D. CONFIDENTIALITY

We will gather the following information as part of this research:

- demographic information and contact information
- responses to questionnaires
- data on how you use the microlearning modules: timing and duration of use, completion rate and question responses
- description of your experience with microlearning and wound care since the workshop

By participating in this study, you agree to let the researchers have access to information about your use of the microlearning. This information will be obtained from the [redacted] e-learning platform by special request. We will not allow anyone to access the information gathered, except people directly involved in conducting the research. We will only use the information for the purposes of the research described in this form.

To verify that the research is being conducted properly, regulatory authorities might examine the information gathered. By participating, you agree to let these authorities have access to the information.

The information gathered will be coded. That means that identifying information (name, username or e-mail address) will be removed and the information will be identified only by a code. The researcher will have a list that links the code to your name. All the information collected during the research project will remain confidential to the extent provided by law. We will protect the information by scanning information gathered on paper (consent forms and first questionnaire) and storing it in a password-protected file on the researcher's password-protected computer. We will destroy the information seven years after the end of the study.

We intend to publish the results of the research. However, it will not be possible to identify you in the published results. Results from this study can be made available to you, if you request it, before publication.

E. CONFLICT OF INTERESTS

The researchers have no conflict of interest to declare.

F. VOLUNTARY PARTICIPATION AND THE RIGHT TO WITHDRAW

You do not have to participate in this research. It is purely your decision. If you do participate, you can stop at any time. Your choice to participate or withdraw from this study will have no bearing on your job or on any work-related evaluations or reports.

You can also ask that the information you provided not be used, and your choice will be respected. If you decide that you don't want us to use your information, you must tell the researcher before April 30, 2019.

There are no negative consequences for not participating, stopping in the middle, or asking us not to use your information. We will tell you if we learn of anything that could affect your decision to stay in the research.

G. CONTACT INFORMATION

If you have questions or if you have a problem you think may be related to your participation in this research study, or if you would like to withdraw, you may communicate with the researcher or with someone on the research team at the following numbers:
Researcher, Naomi Burton-MacLeod: [redacted]
[Hospital] Principal Investigator, [redacted]

For any question concerning your rights as a research participant taking part in this study, or if you have comments, or wish to file a complaint, you may communicate with:
Manager, Research Ethics, Concordia University: (514) 848-2424 ext. 7481 or oor.ethics@concordia.ca.
The Ombudsman of [redacted]

H. SIGNATURES

Research Study Title: Case Study of a Microlearning Follow-Up Initiative to Support Training Transfer

Signature of the participant

I have reviewed the information and consent form. Both the research study and the information and consent form were explained to me. My questions were answered, and I was given sufficient time to make a decision. After reflection, I consent to participate in this research study in accordance with the conditions stated above.

1) Please provide your e-mail address **to receive the microlearning**:

   E-MAIL: _____

2) I wish to receive a copy of the study results by email.

   Yes ☐ No ☐

_____

Name of participant Signature Date

Signature of the person obtaining consent

I have explained the research study and the terms of this information and consent form to the research participant, and I answered all his/her questions.

_____

Name of the person obtaining consent Signature Date

You will be sent a digital copy of the consent form by e-mail within one week for your reference.

Appendix I

Information and Consent Form for Interview and Audio Recording

[Hospital Logo Redacted]

INFORMATION AND CONSENT FORM – Interview and Audio Recording

Study Title: Case Study of a Microlearning Follow-Up Initiative to Support Training Transfer
[Hospital] Protocol number: 2019-5215

Researcher: Naomi Burton-MacLeod, Master's student in Educational Technology
Researcher's Contact Information:
Address: Department of Education, FG-5.150, 1455 de Maisonneuve Street W., Concordia University, Montreal, Quebec, H3G 1M8
Phone: [redacted]
E-mail: naomi.burton-macleod@mail.concordia.ca

[Hospital] Principal Investigator: [redacted]
[Hospital] Principal Investigator's Contact Information:
[redacted]

Faculty Supervisor: Dr. Saul Carliner
Faculty Supervisor's Contact Information:
Address: Department of Education, FG-5.150, 1455 de Maisonneuve Street W., Concordia University, Montreal, Quebec, H3G 1M8
Phone: (514) 848-2424, ext. 2038
E-mail: saul.carliner@concordia.ca

Source of funding for the study:
Social Sciences and Humanities Research Council (SSHRC) of Canada

INTRODUCTION

You are being invited to participate in an interview for the research study mentioned above. This form provides information about what participating would mean. Please read it carefully

before deciding if you want to participate or not. If there is anything you do not understand, or if you want more information, please ask the researcher.

A. PURPOSE OF THE RESEARCH STUDY

The purpose of the research is to describe the experience of using short e-learning, called *microlearning*, as follow-up to an information-heavy workshop when the microlearning is provided in two different ways and to understand if it is viewed by nurses as useful for their work.

B. RESEARCH PROCEDURES

If you participate in the interview, you will be asked to answer questions about your experience returning to work after the wound care workshop and about how the microlearning fit into this experience.

The researcher will coordinate to meet with you at the Hospital, in a private conference room, either before or after your shift. Alternatively, interviews could be conducted by video-conference or telephone. The researcher will request that the interview be audio recorded to help the researcher recall details of the meeting. You have the right to either take a break from the audio recording during the interview or end the audio recording for the remainder of the interview.

In total, participating in this interview will take 1 hour including the time to schedule the interview.

C. RISKS AND BENEFITS

You may or may not benefit from this study. Potential benefits include the development of future microlearning by the Department of Nursing, Continuing Professional Skill Development that best supports your nursing practice.

There is minimal risk to participating in this study. Some people may feel uncomfortable speaking about their work experiences. You do not have to answer a question if you do not feel comfortable doing so.

A possible risk associated with this study is a breach of confidentiality or use of your personal information by a third party. To limit this risk, we will take the steps to protect your confidentiality described in the Confidentiality section, below. Information that you provide to the researcher as part of the microlearning or study will not be shared with your colleagues or manager and it will not have any impact on your employment status as a nurse. This consent

form will NOT be placed in your employment record. Information you provide will have identifying information removed and will be given a code instead. The coded information will be accessed only by people directly involved with the study.

There is no cost to you to participate in this interview and you will not receive financial compensation for participating in this interview. We do not foresee any other risks associated with this study.

D. CONFIDENTIALITY

We will gather the following information as part of this research: a description of your experience with microlearning and wound care since the workshop.

We will not allow anyone to access the information gathered, except people directly involved in conducting the research. We will only use the information for the purposes of the research described in this form.

To verify that the research is being conducted properly, regulatory authorities might examine the information gathered. By participating, you agree to let these authorities have access to the information.

The information gathered by a recording device during the interview will be identifiable by your voice. We will keep the digital recordings in a password-protected file on the researcher's password-protected computer. As soon as the recording is transcribed, the recording will be deleted. The transcription of the recording and the notes taken during the interview will be coded. That means it will be identified only by a code, not your name or other identifying information. The researcher will have a list that links the code to your name. All the information collected during the research project will remain confidential to the extent provided by law. We will protect the information by scanning information gathered on paper (consent forms and first questionnaire) and storing it in a password-protected file on the researcher's password-protected computer. We will destroy the information seven years after the end of the study.

We intend to publish the results of the research. However, it will not be possible to identify you in the published results. If we refer to something that you said during the interview, we will be sure to remove identifying information, such as any reference to your specific work unit, and

will use a non-name, such as "one nurse" or "one of the participants." Results from this study can be made available to you, if you request it, before publication.

E. CONFLICT OF INTERESTS

The researchers have no conflict of interest to declare.

F. VOLUNTARY PARTICIPATION AND THE RIGHT TO WITHDRAW

You do not have to participate in this research. It is purely your decision. If you do participate, you can stop at any time. You can also ask that the information you provided not be used, and your choice will be respected. If you decide that you don't want us to use your information, you must tell the researcher before April 30, 2019.

There are no negative consequences for not participating, stopping in the middle, or asking us not to use your information. We will tell you if we learn of anything that could affect your decision to stay in the research.

G. CONTACT INFORMATION

If you have questions or if you have a problem you think may be related to your participation in this research study, or if you would like to withdraw, you may communicate with the researcher or with someone on the research team at the following numbers:
Researcher, Naomi Burton-MacLeod: [redacted]
[Hospital] Principal Investigator[redacted]

For any question concerning your rights as a research participant taking part in this study, or if you have comments, or wish to file a complaint, you may communicate with:
Manager, Research Ethics, Concordia University: (514) 848-2424 ext. 7481 or oor.ethics@concordia.ca.
The Ombudsman of [redacted]

H. SIGNATURES

Research Study Title: Case Study of a Microlearning Follow-Up Initiative to Support Training Transfer

Signature of the participant

I have reviewed the information and consent form. Both the research study and the information and consent form were explained to me. My questions were answered, and I was given sufficient time to make a decision. After reflection, I consent to participate in this research study in accordance with the conditions stated above.

1) I accept that my participation in the interview be audio-recorded:

   Yes ☐ No ☐

2) I authorize a member of the research study to contact me to check the transcript of what I said.

   Yes ☐ No ☐

Name of participant Signature Date

Signature of the person obtaining consent

I have explained the research study and the terms of this information and consent form to the research participant, and I answered all his/her questions.

Name of the person obtaining consent Signature Date

Appendix J

Initial Script to Recruit Participants at the Workshop

"You've received lot of information today about evidence-based wound care and it can be a lot to remember over time. A new method of workshop follow-up is being offered as part of a study. Small review modules will be provided to study participants that relate to the information covered in the workshop today. The goal is to give you some additional resources to keep what you have learned today fresh. The modules will take no more than 10 minutes to complete and will include some review material, scenarios and a couple of questions. You'll be notified about the modules by e-mail. Some of you will get access to all 3 modules at once to use when you want. Others will have the modules sent one at a time over the next month to be completed at a set frequency. This study is supported by the Department of Nursing, Continuing Professional Staff Development team.

Participation is voluntary, and you can withdraw at any time. You will be assigned to receive microlearning in one of the two different ways and will receive e-mail notification when you can access the microlearning. At the end of the study, in one month's time, you will be asked to complete another short questionnaire like the one today. Several participants will be selected to share their experiences with the researcher in an interview. You can decide at the time you are invited for an interview if you would like to complete that step or not.

Consent forms will be distributed now. Take a few minutes to read them and think about if you would like to participate. If you agree to participate, you will be asked to fill out a brief questionnaire before receiving the microlearning (it is attached to the consent form for your convenience). At the end of the workshop, place the consent form and questionnaire in the envelope provided, whether you filled them out or not, and then place them in the confidential, sealed box on the table by the door. This box will be opened by the researcher only. If you would like some more time to think about participation you can take the consent form with you, but you must return it to the researcher in the next week (by ***date***) if you would like to participate. If you have any questions, the researcher is here today to answer them individually or can be contacted by the e-mail address on the consent form."